

# NAVAL POSTGRADUATE SCHOOL Monterey, California



## THESIS

COMPARATIVE DESIGN ANALYSIS OF A FUEL  
CELL POWERED COAST GUARD CUTTER

by

John Francis Comar

June 1996

Thesis Advisor:

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This investigation studied the impact of using fuel cells as the primary power source in a ship design. Three different fuel cells were modeled: Phosphoric Acid, Proton Exchange Membrane, and Molten Carbonate. These models were compared against a baseline design containing a more conventional powerplant. The models were built and optimized using the "Advanced Surface Ship Evaluation Tool" (ASSET/MONOSC). Specifically, payload, endurance, sustained speed, and hull depth were held constant, while length, beam, and draft were optimized to provide a balanced design. Full load displacement and required fuel load were compared against the baseline values. Conclusions concerning the potential value of a fuel cell powerplant were drawn.

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**COMPARATIVE DESIGN ANALYSIS OF A FUEL  
CELL POWERED COAST GUARD CUTTER**

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Lieutenant, United States Coast Guard  
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Submitted in partial fulfillment  
of the requirements for the degrees of

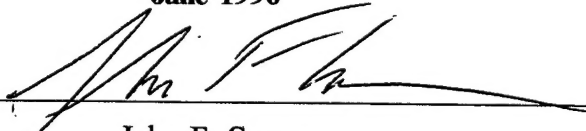
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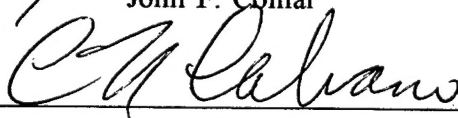
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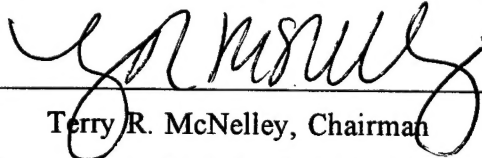


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## **ABSTRACT**

This investigation studied the impact of using fuel cells as the primary power source in a ship design. Three different fuel cells were modeled: Phosphoric Acid, Proton Exchange Membrane, and Molten Carbonate. These models were compared against a baseline design containing a more conventional powerplant. The models were built and optimized using the "Advanced Surface Ship Evaluation Tool" (ASSET/MONOSC). Specifically, payload, endurance, sustained speed, and hull depth were held constant, while length, beam, and draft were optimized to provide a balanced design. Full load displacement and required fuel load were compared against the baseline values. Conclusions concerning the potential value of a fuel cell powerplant were drawn.



## TABLE OF CONTENTS

I.	INTRODUCTION.....	1
A.	EXPECTATIONS FOR FUEL CELLS AS PRIME MOVERS.....	1
1.	Fuel Efficiency.....	1
2.	Environmental Friendliness.....	1
3.	Reduced Ship Signature.....	3
4.	Modularity.....	5
B.	PURPOSE OF THESIS.....	6
C.	APPROACH.....	6
II.	BASIC FUEL CELL OPERATING PRINCIPLES.....	9
A.	HISTORICAL PERSPECTIVE.....	9
1.	General History.....	9
2.	Selection of Fuel Cells for Study....	11
3.	Recent History of Subject Fuel Cells.	11
B.	FUEL CELL CHEMISTRY.....	12
C.	TECHNOLOGICAL ISSUES.....	14
III.	DISCUSSION OF ASSET/MONOSC.....	19
A.	PROGRAM DESCRIPTION.....	19
B.	MODEL DEVELOPMENT.....	19
1.	Fuel Cell Model Comparison vs. Baseline.....	20
2.	Machinery Plant Development.....	21
3.	Hull Modifications.....	24
C.	MODELING LIMITATIONS.....	25
IV.	RESULTS AND ANALYSIS.....	27
A.	ASSET/MONOSC OUTPUT.....	27

B.	GRAPHICAL OUTPUT.....	38
C.	ANALYSIS OF RESULTS.....	40
V.	CONCLUSIONS AND RECOMMENDATIONS.....	45
A.	CONCLUSIONS.....	45
B.	RECOMMENDATIONS.....	47
APPENDIX A.	BASELINE MODEL SUMMARY.....	49
APPENDIX B.	FUEL CELL DIESEL MODELING DETAILS.....	63
APPENDIX C.	10.8 MEGAWATT PEMFC MODEL SUMMARY.....	65
APPENDIX D.	12.0 MEGAWATT PEMFC MODEL SUMMARY.....	79
APPENDIX E.	13.2 MEGAWATT PEMFC MODEL SUMMARY.....	93
APPENDIX F.	10.8 MEGAWATT MCFC MODEL SUMMARY.....	107
APPENDIX G.	12.0 MEGAWATT MCFC MODEL SUMMARY.....	121
APPENDIX H.	13.2 MEGAWATT MCFC MODEL SUMMARY.....	135
APPENDIX I.	10.8 MEGAWATT PAFC MODEL SUMMARY.....	149
APPENDIX J.	12.0 MEGAWATT PAFC MODEL SUMMARY.....	163
APPENDIX K.	13.2 MEGAWATT PAFC MODEL SUMMARY.....	177
	LIST OF REFERENCES.....	191
	INITIAL DISTRIBUTION LIST.....	193

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## **I. INTRODUCTION**

### **A. EXPECTATIONS FOR FUEL CELLS AS PRIME MOVERS**

Over the last several years, the U.S. Navy has done some investigation of the use of fuel cells to replace diesel engines and gas turbines aboard its ships. The U. S. Coast Guard has recently joined in the study of the use of fuel cells for shipboard propulsion and ship's service electrical power. Fuel cells provide many advantages to both the ship designer and ship operator. These advantages include: higher fuel efficiency, environmental friendliness, reduced ship signature, and modularity.

#### **1. Fuel Efficiency**

In this age of shrinking natural resources and rising fuel costs, enhanced fuel efficiency is a primary concern, especially to organizations which depend on fossil fuels to perform their primary missions. Studies have shown that fuel cells can operate at efficiencies as high as 60% (Goubalt and others 1994, p.62). This is a substantial increase over traditional reciprocating engines and gas turbines that operate in the 30% efficiency range.

#### **2. Environmental Friendliness**

Environmental impact is significantly reduced through the use of fuel cells. Typical emissions from conventional engines include nitrous oxide (NOx), carbon monoxide (CO), and unburned hydrocarbons (HC). With a fuel cell, these pollutants are virtually non-existent. A graph of expected



emissions versus current emissions (over the life of a ship) is shown in Figure 1-1 below.

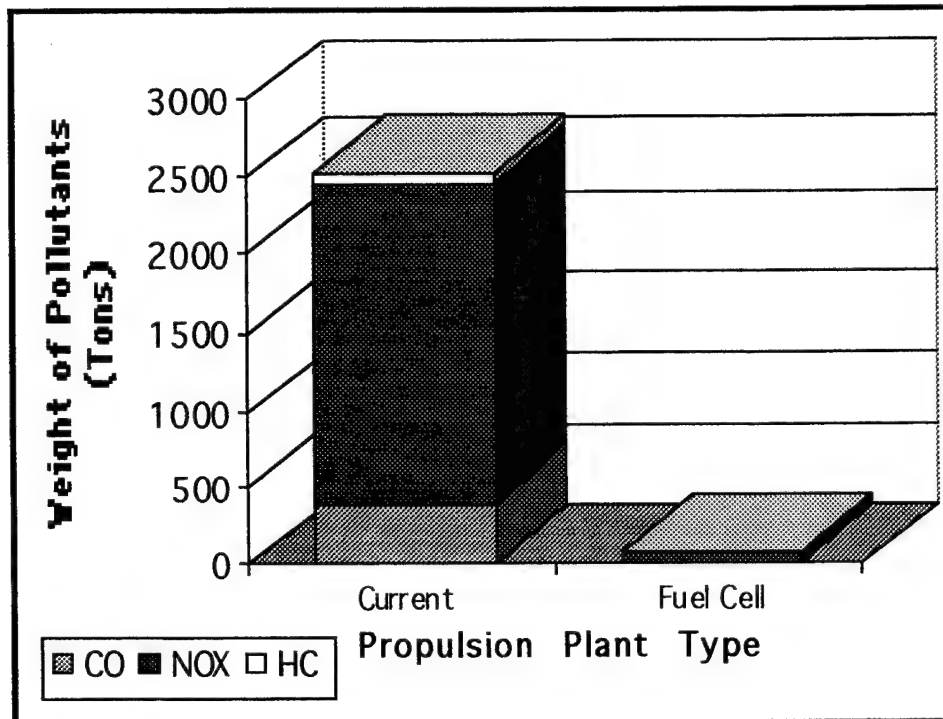


Figure 1-1, Pollution Emission (after Goubalt and others 1994, p. 73)

Fuel cells require a source of hydrogen and oxygen to operate. For obvious safety reasons, hydrogen storage on a combatant is not feasible. The current fuel of choice is diesel fuel, which can be reformed to provide hydrogen gas. It is available over the entire globe and is safe to carry aboard ship. No modifications to existing ships or logistics system infrastructure are necessary to continue its use.

The only measurable exhaust components from a fuel cell are water ( $H_2O$ ) and carbon dioxide ( $CO_2$ ). The use of diesel fuel as the hydrogen source is attractive but introduces sulfur dioxide ( $SO_2$ ) into the emission mix. Most fuel cells

are sulfur intolerant; thus, the sulfur must be refined or processed out of the fuel stream prior to introduction to the actual cell stack. It is expected that tightened environmental laws will force diesel fuel suppliers to produce only sulfur free fuels in the near future. (Goubalt and others 1994, p. 71)

### **3. Reduced Ship Signature**

Reduced ship signature is of primary concern to today's naval ship designer. The advent of thermal imagery and infra-red seekers on anti-ship missiles has made current ships with reduced radar cross-section easy targets for heat-seeking missiles. This is due to the high exhaust temperatures from the main engines. Fuel cell exhaust temperatures, on the other hand, are much lower, as Figures 1-2 and 1-3 illustrate. Note: PEMFC, MCFC and PAFC in the figures refer to specific types of fuel cells; CODOG refers to a COmbined Diesel Or Gas turbine power plant; GT refers to Gas Turbine; ICR refers to a type of gas turbine, the InterCooled Regenerative gas turbine.

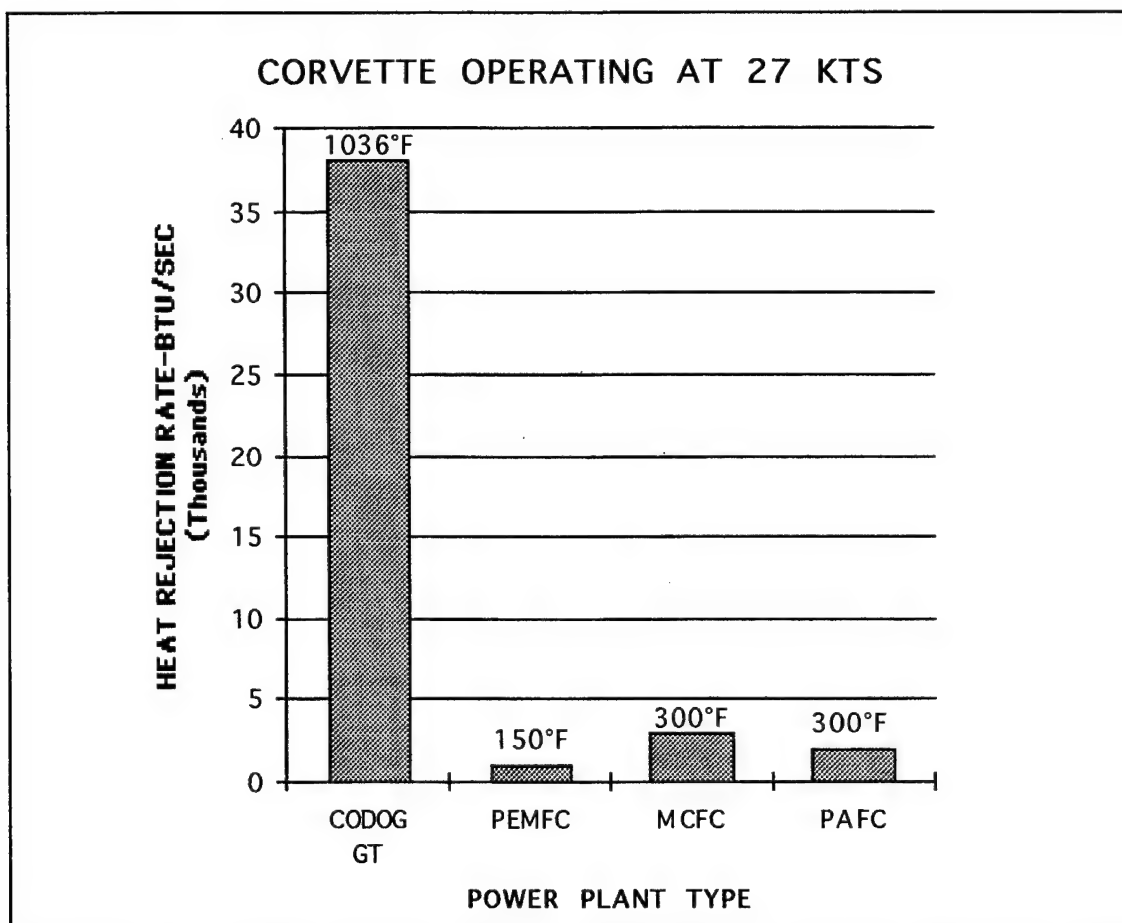


Figure 1-2, Heat Rejection to Atmosphere, (after Goubalt and others 1994, p. 72)

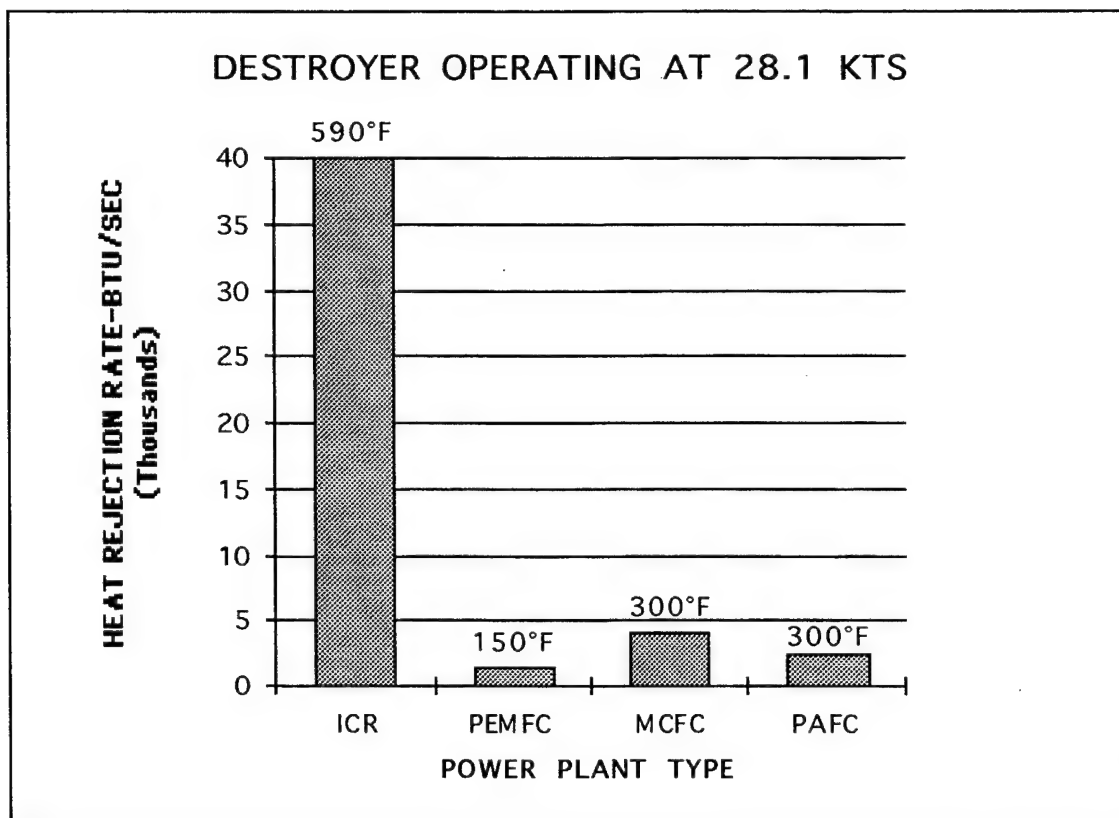


Figure 1-3, Heat Rejection to Atmosphere, (after Goubalt and others 1994, p. 72)

#### **4. Modularity**

Fuel cells lend themselves very well to modularity due to their construction. The cells are primarily composed of stacked plates with no moving parts (other than valves and supporting auxiliary equipment such as pumps and blowers). Additional details of how fuel cells operate and what supporting equipment is required are discussed in later chapters. Large fuel cells could conceivably be separated into smaller groups of stacks and placed in strategic locations throughout the ship. This is advantageous under a concept known as "federated compartments," in which all the electric power and hotel services for each compartment are

provided by a power pack and hotel service module in that compartment. This concept greatly enhances survivability, by reducing the probability that damage to a single compartment, such as a main machinery space, would affect the entire ship.

## **B. PURPOSE OF THESIS**

The purpose of this study is to quantify the impact on ship characteristics from the use of fuel cells as a source of propulsion and ship service electrical power on a ship designed for Coast Guard missions in the 21st Century. This study will also attempt to validate previous work done by the Office of Naval Research (ONR), Enabling Technologies Project. Furthermore, the results of this study will be provided to the U.S. Coast Guard's Research and Development Center in Groton, Connecticut, to be used as input for future Coast Guard ship designs and modifications.

## **C. APPROACH**

As mentioned previously, this study will investigate fuel cell power on an existing design. This design will hereafter be referred to as the "baseline" ship. The baseline ship was designed as part of the Total Ship Systems Engineering program at the Naval Postgraduate School. It was the Coast Guard portion of a study to develop a common platform for both Navy and Coast Guard use. Figure 1-4 illustrates the baseline ship. The baseline ship was developed on a computer modeling program (ASSET/MONOSC, described later) which uses historical and empirical data to produce a feasibility level design.

The fuel cells characteristics were substituted into the baseline design model, replacing the existing power plant characteristics which consisted of recuperated gas turbines and diesel engines. All performance parameters (range and speed), and auxiliary machinery details (where appropriate) were maintained. Only the hull parameters (length, beam, draft, superstructure size, and displacement) were modified or allowed to change. Computer model runs were then conducted on the fuel cell designs. This thesis describes the process and the results of this computer modeling.

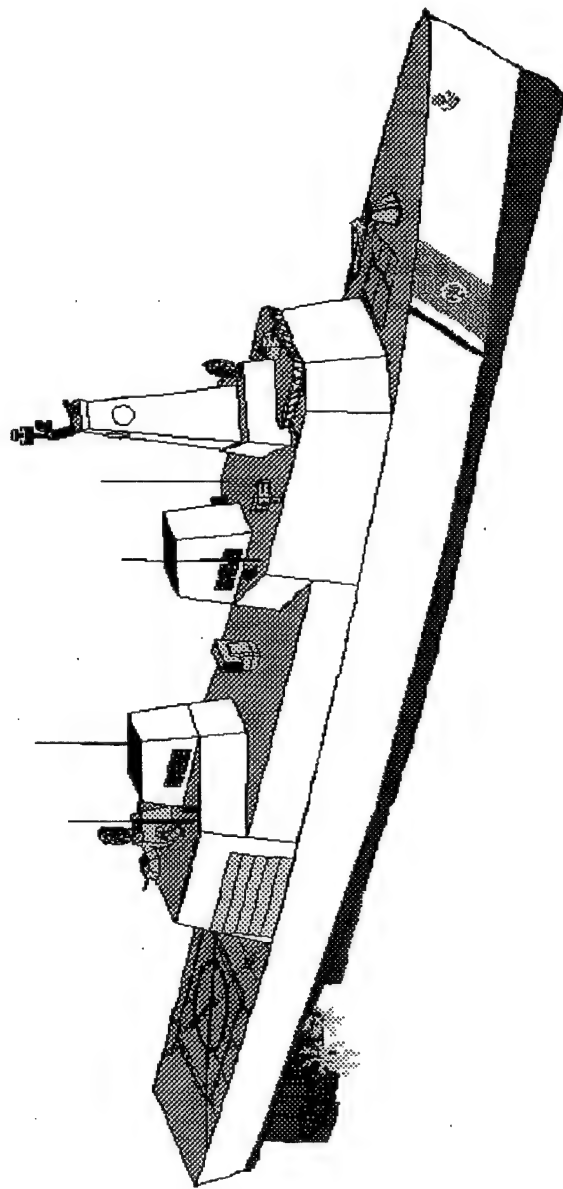


Figure 1-4, Baseline Ship, (after TR NPS-ME-96-004, 1996)

## II. BASIC FUEL CELL OPERATING PRINCIPLES

### A. HISTORICAL PERSPECTIVE

#### 1. General History

The development of fuel cells, while often considered recent, can be traced to the mid-nineteenth century. The first experiments in which electricity was generated by supplying hydrogen and oxygen to two separate electrodes immersed in sulfuric acid were described by Sir William Grove in 1839 (Williams 1966, p. 1). Although the current from this cell was rather small, Grove was encouraged by the results, and in 1842, constructed a bank of fifty such cells, which he called a "gaseous voltaic battery" (Appleby and Foulkes 1989, p.8). In the period between 1839 and 1932, most experiments dealt with analyzing and understanding the chemistry of various fuel cell types.

In 1932, Bacon working at Cambridge (England) started to investigate the possibility of building a powerful fuel battery. Bacon set out to make a useful power source based on a simplified hydrogen-oxygen cell. This pioneer work, which culminated in the demonstration of a five kilowatt hydrogen-oxygen fuel battery in 1959, undoubtedly did much to stimulate the current wave of interest in fuel cells. (Williams 1966, pp. 6-7)

In October of 1959, Dr. Harry Karl Ihrig of the Allis-Chalmers Manufacturing Company, demonstrated a 20 horsepower fuel cell powered tractor (Appleby and Foulkes 1989, p.11). In 1964, Allis-Chalmers produced a 750 W fuel cell for the powering of a one man submersible designed by the Electric



Boat Division of General Dynamics. This power plant was the first practical application of a fuel cell as a motive power source. (Appleby and Foulkes 1989, p. 11)

The National Aeronautics and Space Administration (NASA) provided the next big developmental push in the fuel cell industry. Its desire for a high power density, attitude- and ambient pressure-independent power source for the manned space program resulted in over 200 contracts awarded to develop fuel cell power plants. (Appleby and Foulkes 1989, pp. 11-12)

The success of fuel cells in the manned space program notwithstanding, the fuel cell industry experienced a slowdown in the late 1960's and early 1970's. Four major problem areas were identified: (1) hydrogen was the only effective, non-exotic fuel; (2) the hydrogen needed to be pure, which created production problems; (3) short lifetimes existed for the materials involved; (4) the fuel cell industry tended to oversell itself, which led to funding problems. (Appleby and Foulkes 1989, p. 12)

In 1967, the American Gas Association funded a long term effort led by United Technologies Corporation (UTC) to develop a reformed natural gas powered cell, using an acid electrolyte. This cell became known as the Phosphoric Acid Fuel Cell (PAFC). In 1971-1972, UTC realized that economies of scale could be sufficient to make it (PAFCs) economical for the production of primary electric utility power. This, coupled with the oil embargo of 1973-1974, renewed interest

and funding (both commercial and federal) in fuel cells for central power station applications. (Appleby and Foulkes 1989, p.13)

## **2. Selection of Fuel Cells for Study**

Three different cells were selected for inclusion in this study: Phosphoric Acid (PAFC), Proton Exchange Membrane (PEMFC), and Molten Carbonate (MCFC). While not a complete list, these three cells give a fair representation of the various characteristics of different types of cells.

Phosphoric acid cells were chosen for their current power generation capabilities and are perhaps the most mature cells in terms of development.

Proton exchange membrane cells were chosen because they show the most promise for shipboard (naval) use due to the high power density (Goubault and others 1994, p.62).

Molten carbonate cells were chosen for thier apparent high efficiency, especially when combined with a bottoming cycle which takes advantage of the high exhaust temperatures.

## **3. Recent History of Subject Fuel Cells**

Study of shipboard applications using Phosphoric acid cells occurred in the early 1980s. The Departments of Energy and Transportation (MARAD) funded several studies with Arctic Energies LTD. (AEL), investigating the use of PAFCs for both auxiliary and main propulsion power for surface ships and commercial submarines. (Kumm 1994, p. 3) Funding was cut short, however, before a prototype plant was built.

PAFCs are currently the most prevalent cells in operation and production. "About 200 multikilowatt PAFC plants, providing nearly 50 megawatts of total energy, are installed or on order throughout the world" (Hirschenhofer and McClelland 1995, p. 84).

Proton Exchange Membrane cells, also known as Polymer-Electrolyte fuel cells (PEFC), were first used in 1959. PEFCs were used as the primary source of power on all of the Gemini space flights of the early 1960's. (Scoles and Sapyta 1995, p. 50) Proton exchange membrane cells have been looked on with great interest by the Navy. However, the commercial power generating industry has virtually ignored development in recent years for several reasons which will be explained later.

Molten carbonate cells have received a great deal of attention lately from industry, with several prototype plants built in the U.S. (Santa Clara and La Brea, California). The Navy has shown interest in a specific type of MC cell, one which uses its own stack heat to reform the fossil fuel (in this case, diesel) internally, eliminating the requirement for an external autothermal reformer. These cells are called "Direct Fuel Cells", or DFCs.

## **B. FUEL CELL CHEMISTRY**

All three cells operate similarly. Gaseous fuels are fed continuously to the anode (negative electrode) and an oxidant (i.e. oxygen from the air) is fed continuously to the cathode (positive electrode), and electrochemical reactions

take place to produce an electric current (Goubault and others 1994, p.60). The difference among the cells is the nature of the electrolyte, which gives each cell type its name.

The operating principle of all cells is relatively simple and is best characterized by Figure 2-1 below.

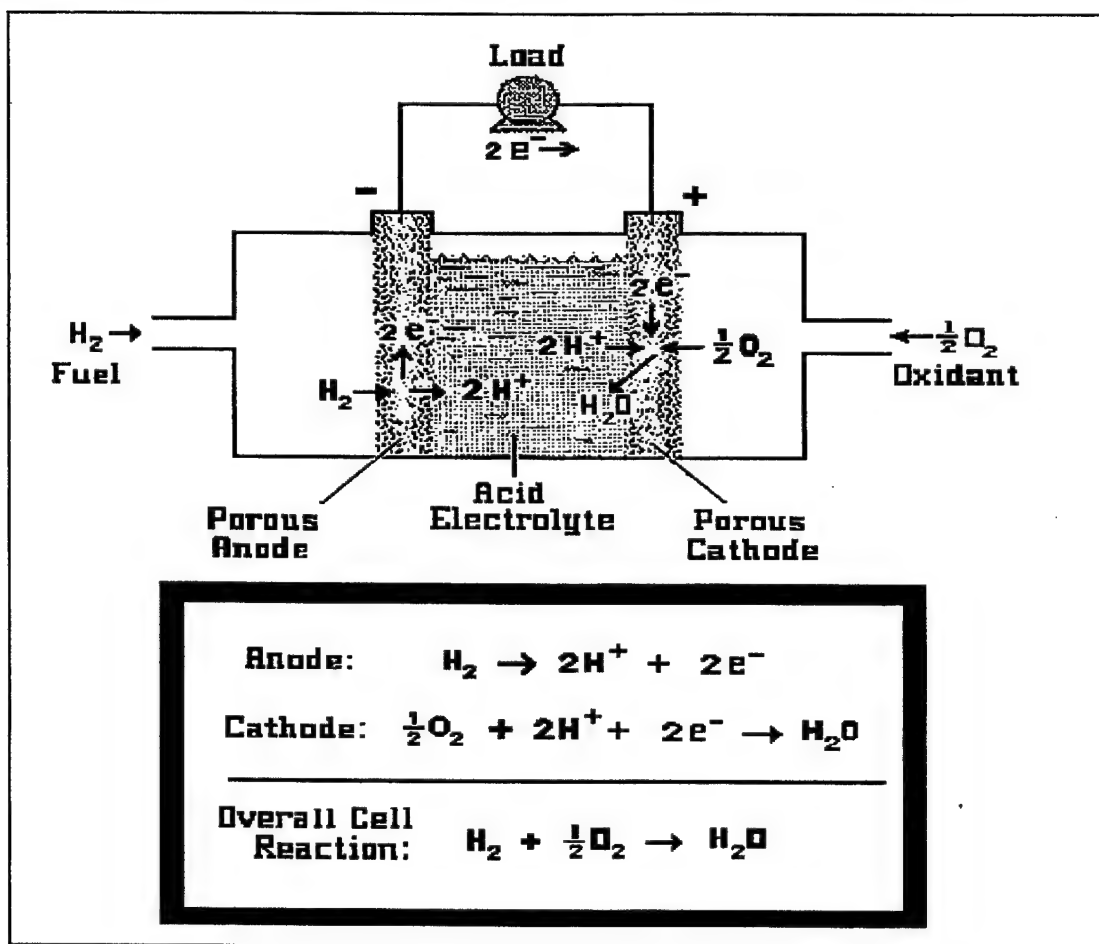


Figure 2-1, Cell Chemistry, (from Appleby and Foulkes 1989, p. 5)

As shown above, the anode and cathode are separated by an ion-conducting electrolyte (in this case, acid). The MC cell uses the carbonate ion ( $\text{CO}_3^-$ ), (Appleby and Foulkes 1989,

p. 6), while the PEM cell uses a sulfonated-fluoropolymer membrane ( $H^+$  ion). (Scoles and Sapyta 1995, p. 50)

### **C. TECHNOLOGICAL ISSUES**

While fuel cells have come a long way since the 1960's, there are still several issues that need to be resolved before fuel cells can be successfully integrated into a shipboard environment. Perhaps the greatest issue, is the fuel itself. For reasons of safety, diesel fuel is the fuel of choice for any naval shipboard power plant. Diesel's relatively high flashpoint and its long-term storage stability make it ideal for shipboard use. A fully capable and competent logistic system (both military and commercial), whose continued use would make common sense economically, is already in place. Most large scale (multi-megawatt) power plants use natural gas, synthetic coal gas, pure hydrogen, naphtha based or alcohol (methanol) based fuels. None of these fuels lends itself to large scale, safe, reliable storage on a ship that may see hostile fire several times during its 30-50 year service life.

Use of diesel fuel, which has been successful on molten carbonate cells, creates some problems for the ship designer. The first hurdle to overcome is the sulfur content in current diesel fuels, since all current types of fuel cells are sulfur intolerant (Goubault and others 1994, p. 60). The additional space and weight to account for the equipment necessary to remove the sulfur must be realized at the outset of the ship design process. Based on the models investigated

in this study, this equipment could account for up to 9 Ltons and 100 square feet of deck area. It should be noted that desulfurizer equipment of the size required for this study has never been built for a naval ship.

The second technological hurdle is the reforming of the fuel itself. Diesel by itself is not a suitable fuel for direct feed into the cell. It must be reformed into a hydrogen rich gas, which requires energy. Several cell types (molten carbonate, as stated before, and solid oxide) generate a great deal of heat which can be scavenged for fuel reformation.

Proton exchange membrane and phosphoric acid cells on the other hand, do not generate sufficient heat for scavenging. Additional fuel must be consumed to power the reformers, reducing overall efficiency. Because the PEMFCs are CO-intolerant, the CO in the reformed fuel stream must be "shifted" to benign CO<sub>2</sub>. This, in turn creates a water balance problem in the stack, due to the high temperature reformat and low temperature anodes. (Kumm 1994, p. 9) These issues, along with the same weight, space and reliability questions become a source of concern to the designer.

Operationally, the PEMFC is the ideal. It is small, lightweight, and has very short start up time. This is not so with molten carbonate and phosphoric acid cells. (Goubalt and others 1994, p. 64) The ability to change speed rapidly is essential to a naval ship.

Assuming a MCFC powered naval ship would spend a majority of its time at reduced power levels, most likely involving a limited portion of the installed cells, a demand for full power would require several hours to achieve. This condition could be countered by using more cells and dumping the "excess" power overboard, so to speak. (There is no utility to sell excess power to at sea). This again, reduces efficiency.

Perhaps the greatest barrier to development of PEMFCs in a size large enough to power a naval ship is lack of support in the commercial power industry. (Kumm 1994, p. 8) This is due to the PEMFC's inability to provide heat for fuel reformation and its lower overall efficiency. This lack of industry funding and research could prove to be detrimental to the use of PEMFCs in large capacity naval power plants.

Molten carbonate and phosphoric acid fuel cells show the greatest potential for shipboard use, when only efficiency is looked at. The additional weight and space requirements, however, overshadow the effect of higher efficiency, but the technological risk is smaller with the MCFCs and PAFCs. The PAFCs, as stated before, are currently operating in capacities large enough to power the designs in this study. Molten carbonate fuel cell technological hurdles are rapidly being overcome, with prototype commercial plants currently under construction, and successful operation of DFCs at the Energy Research Corporation, Danbury, Connecticut. Figure 2-2 on the following page shows what a DFC stack looks like.

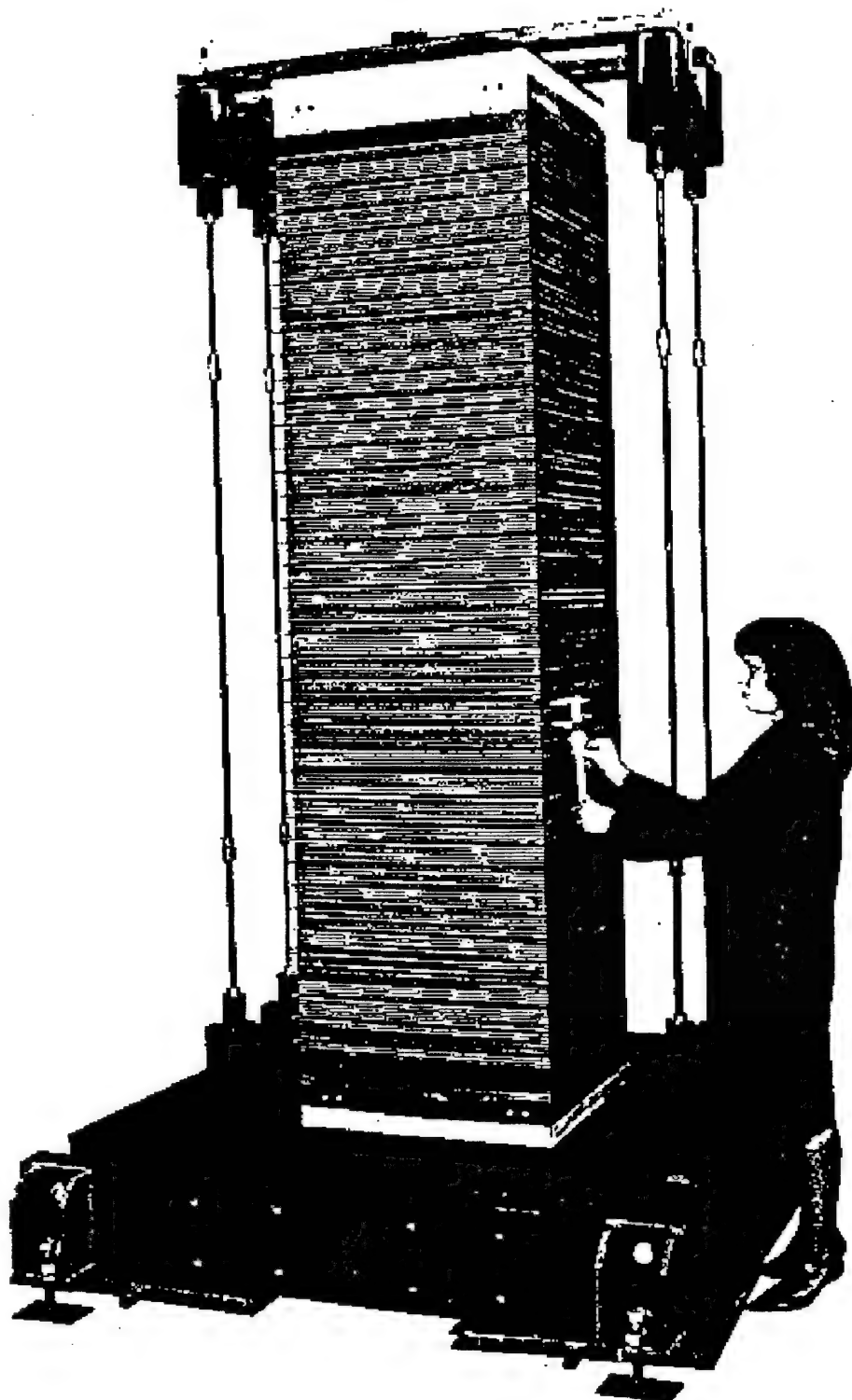


Figure 2-2, DFC Cell Stack (From Kumm 1994,p. 6)





### **III. DISCUSSION OF ASSET/MONOSC**

#### **A. PROGRAM DESCRIPTION**

ASSET/MONOSC is the acronym for the Advanced Surface Ship Evaluation Tool (ASSET) Monohull Surface Combatant (MONOSC) Program. It is an interactive computer program for use in the exploratory and feasibility design phases of monohull surface combatants. ASSET/MONOSC addresses most of the major technological domains of naval architecture that are relevant to the design of such ships, including geometric definition of hull and superstructure, hull subdivision, hull structure, resistance, appendages, propulsors, machinery, weight, space, hydrostatics, seakeeping, manning and cost. The program features design synthesis capability, database management, and extensive input/output options including interactive graphics and use of either English or metric units. (ASSET/MONOSC User Manual 1990) ASSET/MONOSC version 3.3+ was used in this study.

#### **B. MODEL DEVELOPMENT**

All three fuel cell powered models were derived from a baseline model. This baseline model was developed in a previous study by the Total Ship Systems Engineering (TSSE) program at the Naval Postgraduate School. A summary of the baseline ship characteristics is shown in Appendix A.

## **1. Fuel Cell Model Comparison vs. Baseline**

At the beginning of the study, several parameters were chosen to gauge the performance of the models. The parameters chosen were: full load displacement, and usable fuel weight. Full load displacement was chosen, because generally, if a ship is lighter, it will be cheaper to build. Usable fuel weight was chosen, because, for a given endurance, a lower usable fuel weight equates to a more efficient design (in terms of fuel usage). Endurance range and speed were thus held constant, as was sustained speed. Ranking the parameters, as to which one is more important, is difficult. This is due to the fact that generally, as displacement goes down, resistance goes down with it, thus requiring less fuel to achieve the required range. Economically speaking, unless the change in displacement is significant (on the order of several hundred tons), acquisition cost will not change appreciably and is a one-time cost differential. With fuel usage, however, every ton of fuel (310.42 gallons) is worth approximately \$211 (in 1996 dollars). As this resource diminishes, its cost (in 1996 dollars) can only be expected to increase. Fleetwide, the fuel savings could be significant. This study will not determine which parameter is more important. It will simply state whether the specific parameter impact was positive, negative or unchanged. To do otherwise would imply a detailed cost analysis had been done, which is beyond the scope of this study. Another factor not adjusted from the

baseline is the manning level. While a reduction in manning is to be expected for fuel cell power, it is not known to what extent that reduction would be realized on the fuel cell models.

## **2. Machinery Plant Development**

The data file for the baseline ship was modified to create the fuel cell powered models. Version 3.3+ of ASSET/MONOSC does not have the capability to directly simulate fuel cells. This was done by describing the cells as diesel engines, while giving them the physical characteristics and operating profiles of fuel cells. Parameters associated with each fuel cell type, such as weight, physical dimensions, net horsepower, air flow, 50% power specific fuel consumption (SFC), and exhaust temperature were input into the modified data file.

Characteristics for the fuel cells were developed using a computer modeling program held at the Carderock Division of the Naval Surface Warfare Center (Smith, 1993). This program uses optimal operating characteristics to predict weight and volume, and conduct heat and mass balances (Goubalt and others 1994, p. 60). Three different power levels were chosen based on the total power required for the baseline ship to achieve sustained speed (approximately 12 megawatts). The two other levels, 90% and 110% of 12 MW, were used to determine if required power levels would change with displacement. Tables 3-1, 3-2 and 3-3 on the following pages show the characteristics of each fuel cell.

		Proton Exchange Membrane 0.75 v		
Nominal Power, MWatt		10800	12000	13200
Net Power	kWatts	10853	12059	13264
Air Flow	SCFS	320.6	356.3	391.9
Exhaust Flow	SCFS	335	372.3	409.5
Exhaust Temp	Deg. F.	150	150	150
Sea H2O	GPM	1674.5	1860.8	2046.6
Potable H2O	GPM	9.7	10.8	11.8
Cost: Fuel Cell	\$/kW	312.3	312.3	312.3
: BOP	\$/kW	659.6	648.3	638.5
Fuel Cell Wt	Ltons	10.1	11.2	12.3
Fuel Cell Vol	Cu. Ft	1074.8	1194.4	1313.7
BOP Wt	Ltons	14.2	15.3	16.3
Desulfurizer Wt	Ltons	4.7	5.2	5.7
BOP Vol	Cu. Ft.	747.8	800.8	852.3
Desulfurizer Vol	Cu. Ft.	214.5	238.4	262.2
Fuel, 125%	Lb\kW-hr	0.463	0.463	0.463
100%	Lb\kW-hr	0.4507	0.4507	0.4507
75%	Lb\kW-hr	0.4418	0.4418	0.4418
50%	Lb\kW-hr	0.4388	0.4388	0.4388
25%	Lb\kW-hr	0.4542	0.4542	0.4542

Table 3-1, PEMFC Operating Characteristics

		Molten Carbonate 0.75 v		
Nominal Power, MWatt		10800	12000	13200
Net Power	kWatts	10635	11816	12998
Air Flow	SCFS	361.1	401.2	441.3
Exhaust Flow	SCFS	365.5	406.1	446.7
Exhaust Temp	Deg. F.	300	300	300
Sea H2O	GPM	1281.7	1424.1	1566.5
Potable H2O	GPM	3.4	3.8	4.2
Cost: Fuel Cell	\$/kW	159.9	160.4	159.9
: BOP	\$/kW	553.6	797.6	794.2
Fuel Cell Wt	Ltons	114.1	126.8	139.4
Fuel Cell Vol	Cu. Ft	4799	5333.3	5865.3
BOP Wt	Ltons	30.1	32.6	35.3
Desulfurizer Wt	Ltons	7.7	8.3	8.8
BOP Vol	Cu. Ft.	1265.2	1408.3	1486.5
Desulfurizer Vol	Cu. Ft.	382.9	412.2	440.7
Fuel, 125%	Lb\kW-hr	0.5061	0.5074	0.5061
100%	Lb\kW-hr	0.4105	0.4116	0.4105
75%	Lb\kW-hr	0.4115	0.4125	0.4115
50%	Lb\kW-hr	0.4885	0.4897	0.4885
25%	Lb\kW-hr	0.7150	0.7167	0.7149

Table 3-2, MCFC Operating Characteristics

		Phosphoric Acid 0.75 v		
Nominal Power, MWatt		10800	12000	13200
Net Power	kWatts	10333	11481	12629
Air Flow	SCFS	277.7	308.5	353.5
Exhaust Flow	SCFS	291.2	323.5	370.7
Exhaust Temp	Deg. F.	300	300	300
Sea H2O	GPM	1951.9	2168.7	2485
Potable H2O	GPM	0	0	0
Cost: Fuel Cell	\$/kW	444	444	462.5
: BOP	\$/kW	479.5	474.2	487.5
Fuel Cell Wt	Ltons	96.1	106.8	122.3
Fuel Cell Vol	Cu. Ft	6973	7747.5	8877.4
BOP Wt	Ltons	13.1	14.1	15
Desulfurizer Wt	Ltons	4.3	4.8	5.2
BOP Vol	Cu. Ft.	688.1	736.9	784.3
Desulfurizer Vol	Cu. Ft.	197.5	219.5	241.4
Fuel, 125%	Lb/kW-hr	0.4300	0.4300	0.4300
100%	Lb/kW-hr	0.4159	0.4159	0.4159
75%	Lb/kW-hr	0.4051	0.4051	0.4051
50%	Lb/kW-hr	0.4038	0.4038	0.4038
25%	Lb/kW-hr	0.4181	0.4181	0.4181

Table 3-3, PAFC Operating Characteristics

The baseline ship was designed using electric drive with separate ship service generators providing power throughout the ship. As fuel cells generate power directly, there was no need for separate engines and generators for ship's service power. Since ASSET/MONOSC cannot model the fuel cells directly, propulsion derived ship service (PDSS) generators were used. The weight and space for the PDSS generators was then manually deleted using the "Payload and Adjustments" table. The propulsion generators were eliminated as well, using the "Electric Propulsion Adjustment Factor Array". Detailed instructions on the fuel cell modeling and the correction factors used are contained in Appendix B of this report. A standby emergency diesel generator was also included in the fuel cell models for redundancy.

Placement of the fuel cells was relatively straightforward: the existing main machinery spaces were used, but due to the lower height requirement for the fuel cells, a second continuous deck below the main deck was added (vice one deck on the baseline ship). This lower height requirement was derived from the inherent modularity of the fuel cells. Total "engine" volume required (fuel cell volume plus the balance of plant volume) was originally divided by six feet (height) and then the square root of the remaining area provided the length and width. This worked fine for the smaller cells, however, the larger cells required a much larger volume (and corresponding area). The result were cells that did not fit into the hull, due to hull curvature. This was ultimately relieved by increasing the cell height to as high as 9 feet, and allowing the cell width to equal the minimum beam (plus clearance) in the machinery spaces.

### **3. Hull Modifications**

Once the machinery plant was established, a synthesis run was made. Length and depth at station 10 (amidships) were held constant, while beam and draft were varied. Bulkheads were also allowed to move from the baseline positions as well. Bulkhead positions were then fixed after convergence was achieved. A notional superstructure was developed by ASSET/MONOSC automatically for the baseline and fuel cell models. This deckhouse was sized to achieve an area-balanced design. The Space Module was then run to determine if more or less length was needed. Length was

increased or decreased to provide a balance between total area required and total area available. Synthesis runs were made until all pertinent warnings were satisfactorily addressed.

### **C. MODELING LIMITATIONS**

The use of ASSET/MONOSC has its limitations in fuel cell modeling, especially the version (Disk Operating System (DOS) version 3.3+) used. More current versions, utilizing Microsoft Windows 95 operating system, have been developed, but were still in "beta" testing at the time this study was conducted. The latest version has the capability to provide ship service power directly off the propulsion bus. This eliminates the need to simulate a propulsion derived ship service generator and variable speed, constant frequency (VSCF) cycloconverter. The most significant limitation is the actual fuel cell models themselves. Only the PAFC has actually been built to the capacity envisioned for the ships in this study. Thus, the PAFC characteristics are the most accurate. The PEMFC and MCFC are both scaled up versions of the current capacity cells (approximately 250 kilowatts). Highly accurate ASSET/MONOSC models will not be available until full size versions of the plants are built.

Investigation into waste heat reutilization, in the form of a bottoming cycle (steam produced by waste heat, feeding a steam turbine generator), has also not been accomplished via ASSET/MONOSC to date. Use of this excess heat would significantly impact overall efficiency, resulting in much



less fuel needed for achieving the required range. This would take a significant effort to modify the ASSET/MONOSC code, but is recommended for a true evaluation of fuel cell technology aboard naval ships.

As previously mentioned, a detailed cost and manning analysis were not done as part of this study, though both would impact the results. A reduction in manning would result in a smaller, lighter ship, as compared to the baseline. It is not known whether the different fuel cell types would result in different manning levels being required. Another cost impact is the frequency of maintenance, especially major maintenance, such as electrolyte renewal, cell decontamination, membrane replacement, and supporting equipment maintenance.

## **IV. RESULTS AND ANALYSIS**

### **A. ASSET/MONOSC OUTPUT**

The design summaries for each model are shown in Tables 4-1 through 4-10 on the following pages. These summaries detail the specific characteristics for each model. The complete printed output for ASSET/MONOSC model runs comprises over 70 pages of data per model. For reasons of brevity, only the design summaries are shown here. Individual module summaries as well as the parameter and indicator settings for each model are included in the appendices. (This data would permit an interested reader to duplicate the results obtained here or to examine the nature of changes resulting from updates of the ASSET/MONOSC program.)

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.24.22.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

Baseline Design

PRINCIPAL CHARACTERISTICS - FT					WEIGHT SUMMARY - LTON	
LBP				379.0	GROUP 1 - HULL STRUCTURE	1353.4
LOA				401.0	GROUP 2 - PROP PLANT	281.5
BEAM, DWL				52.6	GROUP 3 - ELECT PLANT	270.4
BEAM, WEATHER DECK				57.3	GROUP 4 - COMM + SURVEIL	135.1
DEPTH @ STA 10				34.0	GROUP 5 - AUX SYSTEMS	542.4
DRAFT TO KEEL DWL				15.1	GROUP 6 - OUTFIT + FURN	331.0
DRAFT TO KEEL LWL				15.1	GROUP 7 - ARMAMENT	20.7
FREEBOARD @ STA 3				23.4	-----	
GMT				5.3	SUM GROUPS 1-7	2934.4
CP				0.570	DESIGN MARGIN	366.7
CX				0.795	-----	
SPEED(KT): MAX= 26.0 SUST= 25.0					LIGHTSHIP WEIGHT	3301.1
ENDURANCE: 8000.0 NM AT 14.0 KTS					LOADS	679.1
TRANSMISSION TYPE: ELECT					-----	
MAIN ENG: 2 RGT @ 15769.1 HP					FULL LOAD DISPLACEMENT	3980.2
SHAFT POWER/SHAFT: 14213.2 HP					FULL LOAD KG: FT	21.4
PROPELLERS: 2 - FP - 11.6 FT DIA					MILITARY PAYLOAD WT - LTON	201.5
SEP GEN: 2 D DIESEL @ 2941.3 KW					USABLE FUEL WT - LTON	515.4
24 HR LOAD					-----	
MAX MARG ELECT LOAD					AREA SUMMARY - FT2	
					HULL AREA	- 32445.6
					SUPERSTRUCTURE AREA	- 8236.8
					-----	
					TOTAL AREA	40682.4
					-----	
					VOLUME SUMMARY - FT3	
					HULL VOLUME	- 474468.9
					SUPERSTRUCTURE VOLUME	- 83478.0
					-----	
					TOTAL VOLUME	557947.0

Table 4-1, Baseline Design Summary

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.25.20.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PROTON EXCHANGE MEMBRANE  
10.8 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT					WEIGHT SUMMARY - LTON	
LBP				370.0	GROUP 1 - HULL STRUCTURE	1266.5
LOA				392.0	GROUP 2 - PROP PLANT	313.8
BEAM, DWL				50.4	GROUP 3 - ELECT PLANT	137.9
BEAM, WEATHER DECK				55.0	GROUP 4 - COMM + SURVEIL	132.7
DEPTH @ STA 10				34.0	GROUP 5 - AUX SYSTEMS	541.6
DRAFT TO KEEL DWL				15.0	GROUP 6 - OUTFIT + FURN	310.1
DRAFT TO KEEL LWL				15.0	GROUP 7 - ARMAMENT	20.6
FREEBOARD @ STA 3				23.3	-----	
GMT				4.0	SUM GROUPS 1-7	2723.3
CP				0.570	DESIGN MARGIN	340.3
CX				0.795	-----	
SPEED(KT): MAX= 26.0 SUST= 25.0					LIGHTSHIP WEIGHT	3063.6
ENDURANCE: 8000.0 NM AT 14.0 KTS					LOADS	649.9
TRANSMISSION TYPE: ELECT					-----	
MAIN ENG: 2 D DIESEL @ 14553.9 HP					FULL LOAD DISPLACEMENT	3713.5
SHAFT POWER/SHAFT: 13918.0 HP					FULL LOAD KG: FT	21.1
PROPELLERS: 2 - FP - 11.6 FT DIA					-----	
SEP GEN: 1 F DIESEL @ 1776.9 KW					MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 2974.0 KW					USABLE FUEL WT - LTON	472.3
24 HR LOAD 1138.2					-----	
MAX MARG ELECT LOAD 2708.0					AREA SUMMARY - FT2	
					HULL AREA	34410.8
					SUPERSTRUCTURE AREA	8422.2
					-----	
					TOTAL AREA	42833.1
					-----	
					VOLUME SUMMARY - FT3	
					HULL VOLUME	444234.3
					SUPERSTRUCTURE VOLUME	85374.4
					-----	
					TOTAL VOLUME	529608.7

Table 4-2, 10.8 Megawatt PEMFC Design Summary

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.26.02.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PROTON EXCHANGE MEMBRANE  
12.0 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP			368.0	GROUP 1 - HULL STRUCTURE	1274.1
LOA			389.8	GROUP 2 - PROP PLANT	331.2
BEAM, DWL			50.6	GROUP 3 - ELECT PLANT	138.2
BEAM, WEATHER DECK			55.2	GROUP 4 - COMM + SURVEIL	132.8
DEPTH @ STA 10			34.0	GROUP 5 - AUX SYSTEMS	544.4
DRAFT TO KEEL DWL			15.2	GROUP 6 - OUTFIT + FURN	312.0
DRAFT TO KEEL LWL			15.2	GROUP 7 - ARMAMENT	20.6
FREEBOARD @ STA 3			23.1	-----	
GMT			4.0	SUM GROUPS 1-7	2753.2
CP			0.570	DESIGN MARGIN	344.0
CX			0.795	-----	
SPEED(KT): MAX= 26.0 SUST= 25.0				LIGHTSHIP WEIGHT	3097.2
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	658.9
TRANSMISSION TYPE: ELECT				-----	
MAIN ENG: 2 D DIESEL @ 16171.1 HP				FULL LOAD DISPLACEMENT	3756.1
SHAFT POWER/SHAFT: 14381.0 HP				FULL LOAD KG: FT	21.1
PROPELLERS: 2 - FP - 11.7 FT DIA				-----	
SEP GEN: 1 F DIESEL @ 1786.1 KW				MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 2990.9 KW				USABLE FUEL WT - LTON	479.0
24 HR LOAD			1144.7	-----	
MAX MARG ELECT LOAD			2721.5	AREA SUMMARY - FT2	
				HULL AREA	- 34181.1
				SUPERSTRUCTURE AREA	- 8955.3
				-----	
				TOTAL AREA	43136.4
				-----	
				VOLUME SUMMARY - FT3	
				HULL VOLUME	- 441672.0
				SUPERSTRUCTURE VOLUME	- 90793.7
				-----	
				TOTAL VOLUME	532465.7

Table 4-3, 12.0 Megawatt PEMFC Design Summary

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.26.46.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PROTON EXCHANGE MEMBRANE  
13.2 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP			369.0	GROUP 1 - HULL STRUCTURE	1289.5
LOA			390.7	GROUP 2 - PROP PLANT	348.5
BEAM, DWL			50.6	GROUP 3 - ELECT PLANT	138.6
BEAM, WEATHER DECK			55.2	GROUP 4 - COMM + SURVEIL	133.1
DEPTH @ STA 10			34.0	GROUP 5 - AUX SYSTEMS	548.5
DRAFT TO KEEL DWL			15.4	GROUP 6 - OUTFIT + FURN	314.3
DRAFT TO KEEL LWL			15.4	GROUP 7 - ARMAMENT	20.6
FREEBOARD @ STA 3			23.0		
GMT			4.1	SUM GROUPS 1-7	2793.1
CP			0.570	DESIGN MARGIN	349.0
CX			0.795		
SPEED(KT): MAX= 26.0 SUST= 25.0				LIGHTSHIP WEIGHT	3142.1
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	666.7
TRANSMISSION TYPE: ELECT					
MAIN ENG: 2 D DIESEL @ 17787.0 HP				FULL LOAD DISPLACEMENT	3808.7
SHAFT POWER/SHAFT: 14491.2 HP				FULL LOAD KG: FT	21.1
PROPELLERS: 2 - FP - 11.7 FT DIA					
SEP GEN: 1 F DIESEL @ 1793.3 KW				MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 3006.3 KW				USABLE FUEL WT - LTON	484.5
24 HR LOAD			1150.0		
MAX MARG ELECT LOAD			2732.4	AREA SUMMARY - FT2	
				HULL AREA	- 34190.7
				SUPERSTRUCTURE AREA	- 9306.9
				TOTAL AREA	43497.6
				VOLUME SUMMARY - FT3	
				HULL VOLUME	- 442426.9
				SUPERSTRUCTURE VOLUME	- 94370.5
				TOTAL VOLUME	536797.4

Table 4-4, 13.2 Megawatt PEMFC Design Summary

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.29.38.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

MOLTEN CARBONATE  
10.8 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP			385.0	GROUP 1 - HULL STRUCTURE	1457.5
LOA			403.5	GROUP 2 - PROP PLANT	575.5
BEAM, DWL			51.2	GROUP 3 - ELECT PLANT	141.4
BEAM, WEATHER DECK			55.5	GROUP 4 - COMM + SURVEIL	135.1
DEPTH @ STA 10			34.0	GROUP 5 - AUX SYSTEMS	585.7
DRAFT TO KEEL DWL			16.8	GROUP 6 - OUTFIT + FURN	332.0
DRAFT TO KEEL LWL			16.8	GROUP 7 - ARMAMENT	20.7
FREEBOARD @ STA 3			21.7	-----	
GMT			5.1	SUM GROUPS 1-7	3247.9
CP			0.570	DESIGN MARGIN	405.9
CX			0.795	-----	
SPEED(KT): MAX= 26.0 SUST= 25.0				LIGHTSHIP WEIGHT	3653.7
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	752.2
TRANSMISSION TYPE: ELECT				-----	
MAIN ENG: 2 D DIESEL @ 14261.5 HP				FULL LOAD DISPLACEMENT	4405.9
SHAFT POWER/SHAFT: 14519.0 HP				FULL LOAD KG: FT	19.9
PROPELLERS: 2 - FP - 13.8 FT DIA				-----	
SEP GEN: 1 F DIESEL @ 1832.7 KW				MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 3092.5 KW				USABLE FUEL WT - LTON	570.8
24 HR LOAD			1184.2	-----	
MAX MARG ELECT LOAD			2792.0	AREA SUMMARY - FT2	
				HULL AREA	- 33592.5
				SUPERSTRUCTURE AREA	- 10761.4
				-----	
				TOTAL AREA	44353.9
				-----	
				VOLUME SUMMARY - FT3	
				HULL VOLUME	- 454673.1
				SUPERSTRUCTURE VOLUME	- 109173.7
				-----	
				TOTAL VOLUME	563846.8

Table 4-5, 10.8 Megawatt MCFC Design Summary

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.30.32.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

MOLTEN CARBONATE  
12.0 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP			385.0	GROUP 1 - HULL STRUCTURE	1454.9
LOA			405.5	GROUP 2 - PROP PLANT	618.1
BEAM, DWL			50.9	GROUP 3 - ELECT PLANT	138.4
BEAM, WEATHER DECK			55.1	GROUP 4 - COMM + SURVEIL	134.2
DEPTH @ STA 10			34.0	GROUP 5 - AUX SYSTEMS	574.9
DRAFT TO KEEL DWL			17.0	GROUP 6 - OUTFIT + FURN	325.1
DRAFT TO KEEL LWL			17.0	GROUP 7.- ARMAMENT	20.6
FREEBOARD @ STA 3			21.5		
GMT			5.1	SUM GROUPS 1-7	3266.3
CP			0.570	DESIGN MARGIN	408.2
CX			0.795		
SPEED(KT): MAX= 26.0 SUST= 25.0				LIGHTSHIP WEIGHT	3674.4
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	755.5
TRANSMISSION TYPE: ELECT					
MAIN ENG: 2 D DIESEL @ 15845.3 HP				FULL LOAD DISPLACEMENT	4430.0
				FULL LOAD KG: FT	19.6
SHAFT POWER/SHAFT: 14916.3 HP				MILITARY PAYLOAD WT - LTON	201.5
PROPELLERS: 2 - FP - 13.9 FT DIA				USABLE FUEL WT - LTON	572.1
SEP GEN: 1 F DIESEL @ 1800.0 KW				AREA SUMMARY - FT2	
PD GEN: 2 VSCF @ 3007.3 KW				HULL AREA	- 34879.5
				SUPERSTRUCTURE AREA	- 9268.5
24 HR LOAD			1159.3	TOTAL AREA	44148.0
MAX MARG ELECT LOAD			2740.8		
				VOLUME SUMMARY - FT3	
	OFF	CPO	ENL	HULL VOLUME	- 450131.8
MANNING	15	13	82	SUPERSTRUCTURE VOLUME	- 94002.3
ACCOM	17	15	90		
				TOTAL VOLUME	544134.0

Table 4-6, 12.0 Megawatt MCFC Design Summary



ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.33.24.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

MOLTEN CARBONATE  
13.2 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP			400.0	GROUP 1 - HULL STRUCTURE	1536.9
LOA			420.5	GROUP 2 - PROP PLANT	659.2
BEAM, DWL			51.0	GROUP 3 - ELECT PLANT	141.8
BEAM, WEATHER DECK			55.1	GROUP 4 - COMM + SURVEIL	136.1
DEPTH @ STA 10			34.0	GROUP 5 - AUX SYSTEMS	621.8
DRAFT TO KEEL DWL			17.2	GROUP 6 - OUTFIT + FURN	338.6
DRAFT TO KEEL LWL			17.2	GROUP 7 - ARMAMENT	20.7
FREEBOARD @ STA 3			21.4	-----	
GMT			5.1	SUM GROUPS 1-7	3455.0
CP			0.570	DESIGN MARGIN	431.8
CX			0.795	-----	
SPEED(KT): MAX= 26.1 SUST= 25.0				LIGHTSHIP WEIGHT	3886.8
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	774.9
TRANSMISSION TYPE: ELECT				-----	
MAIN ENG: 2 D DIESEL @ 17430.3 HP				FULL LOAD DISPLACEMENT	4661.7
SHAFT POWER/SHAFT: 13790.1 HP				FULL LOAD KG: FT	19.6
PROPELLERS: 2 - FP - 13.6 FT DIA				-----	
SEP GEN: 1 F DIESEL @ 1839.4 KW				MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 3116.0 KW				USABLE FUEL WT - LTON	588.7
24 HR LOAD 1194.6				-----	
MAX MARG ELECT LOAD 2804.4				AREA SUMMARY - FT2	
				HULL AREA	- 34524.8
				SUPERSTRUCTURE AREA	- 10526.6
				-----	
				TOTAL AREA	45051.4
				-----	
				VOLUME SUMMARY - FT3	
				HULL VOLUME	- 466304.1
				SUPERSTRUCTURE VOLUME	- 106820.4
				-----	
				TOTAL VOLUME	573124.4

Table 4-7, 13.2 Megawatt MCFC Design Summary

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.34.39.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PHOSPHORIC ACID  
10.8 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP			390.0	GROUP 1 - HULL STRUCTURE	1405.6
LOA			408.8	GROUP 2 - PROP PLANT	496.3
BEAM, DWL			51.3	GROUP 3 - ELECT PLANT	140.9
BEAM, WEATHER DECK			55.8	GROUP 4 - COMM + SURVEIL	135.3
DEPTH @ STA 10			34.0	GROUP 5 - AUX SYSTEMS	586.2
DRAFT TO KEEL DWL			15.6	GROUP 6 - OUTFIT + FURN	328.7
DRAFT TO KEEL LWL			15.6	GROUP 7 - ARMAMENT	20.7
FREEBOARD @ STA 3			22.9		
GMT			5.1	SUM GROUPS 1-7	3113.6
CP			0.570	DESIGN MARGIN	389.1
CX			0.795		
SPEED(KT): MAX= 26.1 SUST= 25.0				LIGHTSHIP WEIGHT	3502.7
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	649.9
TRANSMISSION TYPE: ELECT					
MAIN ENG: 2 D DIESEL @ 13856.6 HP				FULL LOAD DISPLACEMENT	4152.5
SHAFT POWER/SHAFT: 13138.5 HP				FULL LOAD KG: FT	20.3
PROPELLERS: 2 - FP - 13.5 FT DIA				MILITARY PAYLOAD WT - LTON	201.5
SEP GEN: 1 F DIESEL @ 1812.4 KW				USABLE FUEL WT - LTON	474.0
PD GEN: 2 VSCF @ 3060.1 KW					
24 HR LOAD				AREA SUMMARY - FT2	
MAX MARG ELECT LOAD				HULL AREA	- 35550.6
				SUPERSTRUCTURE AREA	- 8832.9
				TOTAL AREA	44383.5
				VOLUME SUMMARY - FT3	
				HULL VOLUME	- 471602.8
				SUPERSTRUCTURE VOLUME	- 89568.9
				TOTAL VOLUME	561171.7

Table 4-8, 10.8 Megawatt PAFC Design Summary

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.35.23.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PHOSPHORIC ACIC  
12 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT

LBP	390.0
LOA	408.8
BEAM, DWL	51.4
BEAM, WEATHER DECK	55.8
DEPTH @ STA 10	34.0
DRAFT TO KEEL DWL	15.8
DRAFT TO KEEL LWL	15.8
FREEBOARD @ STA 3	22.7
GMT	5.1
CP	0.570
CX	0.795

SPEED(KT): MAX= 26.1 SUST= 25.0  
ENDURANCE: 8000.0 NM AT 14.0 KTS

TRANSMISSION TYPE: ELECT  
MAIN ENG: 2 D DIESEL @ 15396.0 HP

SHAFT POWER/SHAFT: 13372.5 HP  
PROPELLERS: 2 - FP - 13.5 FT DIA

SEP GEN: 1 F DIESEL @ 1812.6 KW  
PD GEN: 2 VSCF @ 3057.9 KW

24 HR LOAD	1168.8
MAX MARG ELECT LOAD	2762.8

	OFF	CPO	ENL	TOTAL
MANNING	15	13	82	110
ACCOM	17	15	90	122

WEIGHT SUMMARY - LTON

GROUP 1 - HULL STRUCTURE	1427.9
GROUP 2 - PROP PLANT	530.0
GROUP 3 - ELECT PLANT	140.8
GROUP 4 - COMM + SURVEIL	135.3
GROUP 5 - AUX SYSTEMS	588.7
GROUP 6 - OUTFIT + FURN	329.6
GROUP 7 - ARMAMENT	20.7

SUM GROUPS 1-7	3173.0
DESIGN MARGIN	396.5

LIGHTSHIP WEIGHT	3569.5
LOADS	646.6

FULL LOAD DISPLACEMENT	4216.1
FULL LOAD KG: FT	20.3

MILITARY PAYLOAD WT - LTON	201.5
USABLE FUEL WT - LTON	469.2

AREA SUMMARY - FT2

HULL AREA	-	35630.2
SUPERSTRUCTURE AREA	-	8934.0

TOTAL AREA	44564.2
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VOLUME SUMMARY - FT3

HULL VOLUME	-	470102.9
SUPERSTRUCTURE VOLUME	-	90598.3

TOTAL VOLUME	560701.2
--------------	----------

Table 4-9, 12.0 Megawatt PAFC Design Summary

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.36.06.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PHOSPHORIC ACID  
13.2 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP			392.0	GROUP 1 - HULL STRUCTURE	1453.9
LOA			410.9	GROUP 2 - PROP PLANT	576.6
BEAM, DWL			51.4	GROUP 3 - ELECT PLANT	140.3
BEAM, WEATHER DECK			55.8	GROUP 4 - COMM + SURVEIL	135.4
DEPTH @ STA 10			34.0	GROUP 5 - AUX SYSTEMS	594.6
DRAFT TO KEEL DWL			16.1	GROUP 6 - OUTFIT + FURN	331.5
DRAFT TO KEEL LWL			16.1	GROUP 7 - ARMAMENT	20.7
FREEBOARD @ STA 3			22.4		
GMT			5.1	SUM GROUPS 1-7	3253.1
CP			0.570	DESIGN MARGIN	406.5
CX			0.795		
SPEED(KT): MAX= 26.1 SUST= 25.0				LIGHTSHIP WEIGHT	3659.6
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	653.7
TRANSMISSION TYPE: ELECT					
MAIN ENG: 2 D DIESEL @ 16935.5 HP				FULL LOAD DISPLACEMENT	4313.3
				FULL LOAD KG: FT	20.2
SHAFT POWER/SHAFT: 13494.6 HP				MILITARY PAYLOAD WT - LTON	201.5
PROPELLERS: 2 - FP - 13.6 FT DIA				USABLE FUEL WT - LTON	474.2
SEP GEN: 1 F DIESEL @ 1806.7 KW				AREA SUMMARY - FT2	
PD GEN: 2 VSCF @ 3039.7 KW				HULL AREA	- 35551.2
				SUPERSTRUCTURE AREA	- 9027.6
24 HR LOAD			1165.1	TOTAL AREA	44578.8
MAX MARG ELECT LOAD			2753.4		
				VOLUME SUMMARY - FT3	
	OFF	CPO	ENL	HULL VOLUME	- 470239.7
MANNING	15	13	82	SUPERSTRUCTURE VOLUME	- 91553.9
ACCOM	17	15	90		
			TOTAL	TOTAL VOLUME	561793.6

Table 4-10, 13.2 Megawatt PAFC Design Summary

## B. GRAPHICAL OUTPUT

The impact on machinery arrangements provides more detail on the impacts of fuel cells. The baseline machinery arrangement is shown on the next page in Figure 4-1. It is followed by the typical arrangements for the PEMFC, MCFC and PAFC, in Figures 4-2, 4-3 and 4-4, respectively.

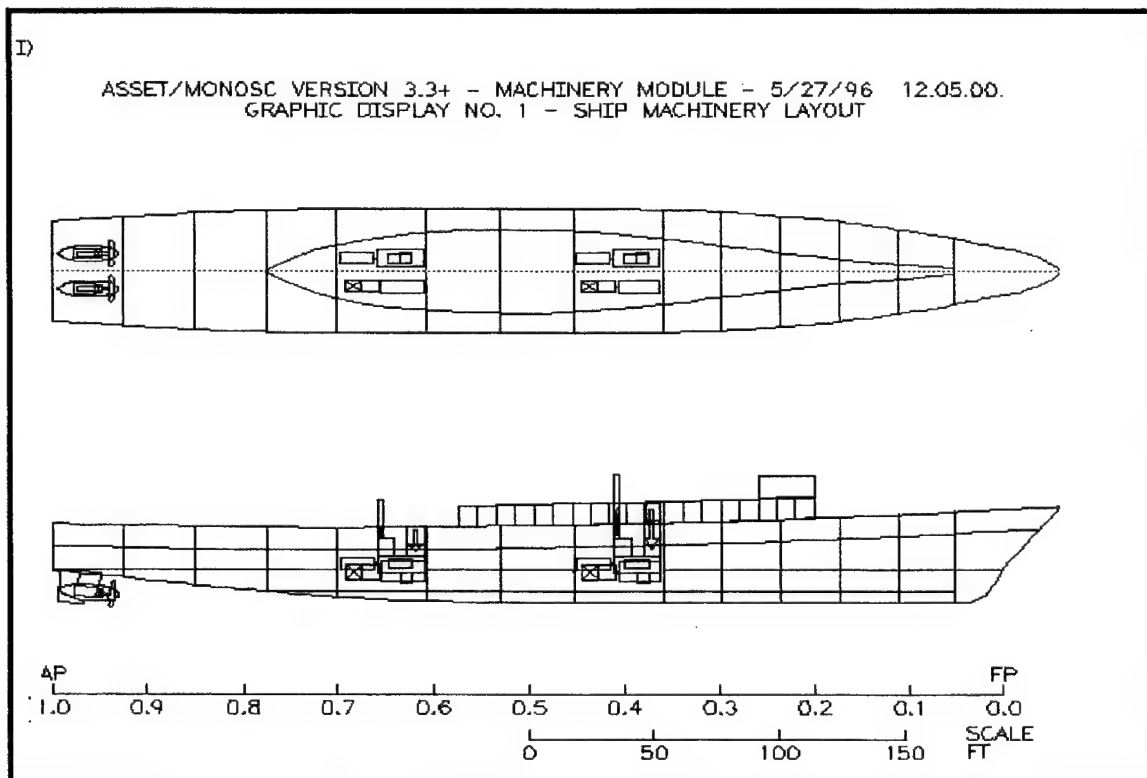


Figure 4-1, Baseline Model Machinery Arrangement

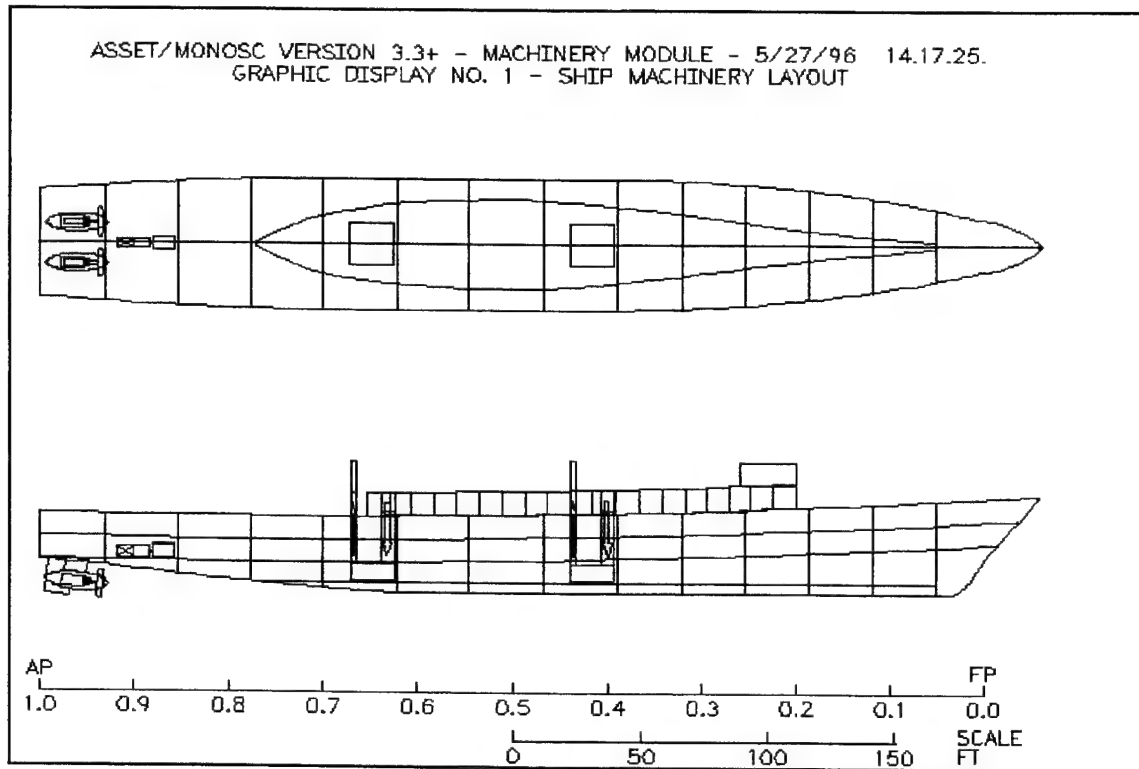


Figure 4-2, PEMFC Model Machinery Arrangements

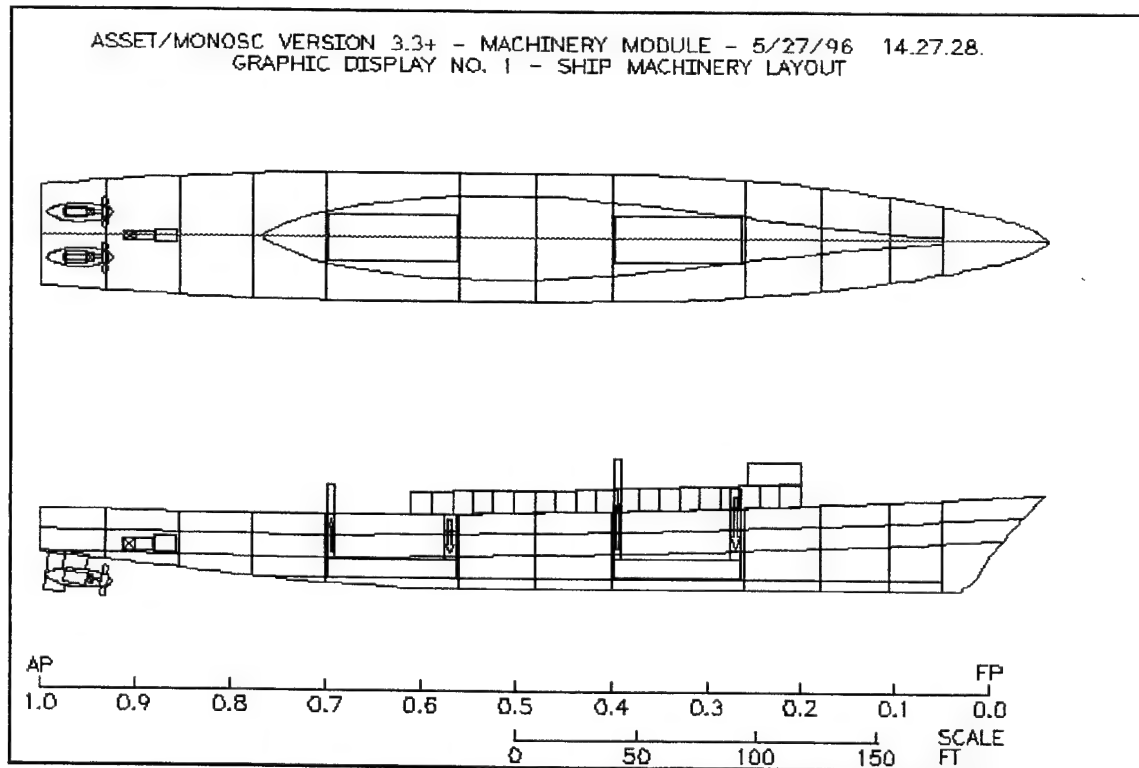


Figure 4-3, PAFC Model Machinery Arrangements

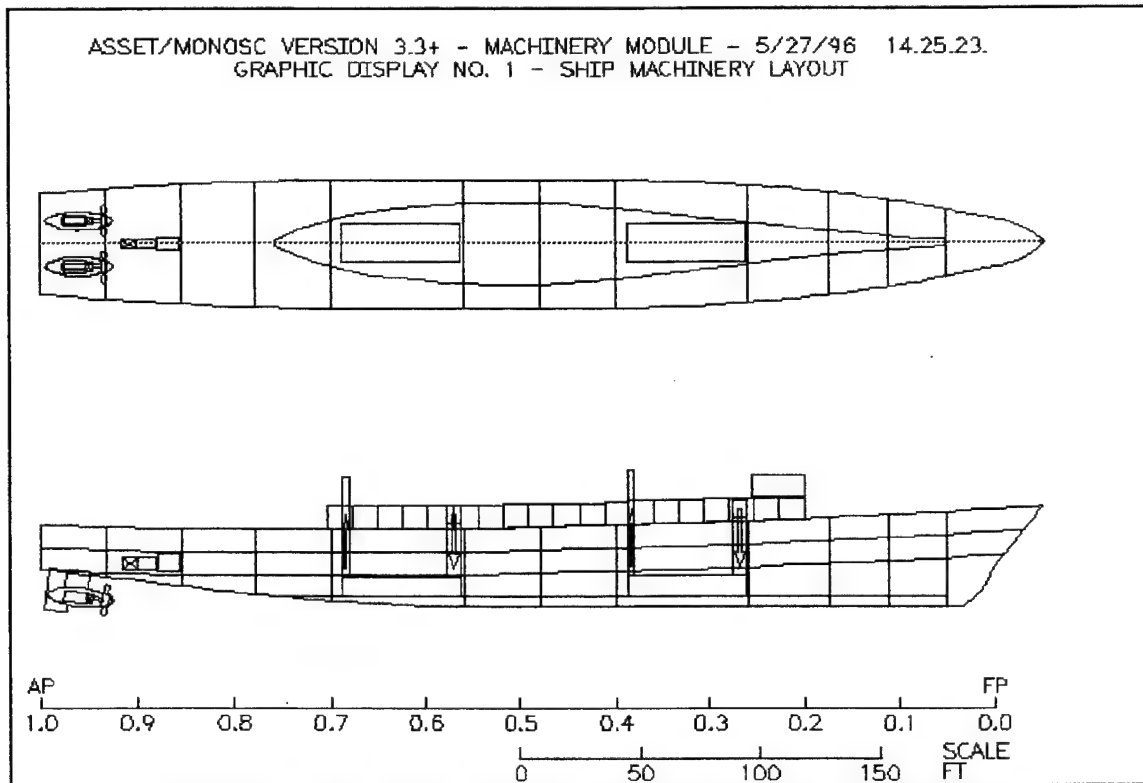


Figure 4-4, MCFC Model Machinery Arrangements

### C. ANALYSIS OF RESULTS

The results of this study were mixed. The PEMFC models showed reduction in both displacement and required fuel weight. The MCFC models produced gains in both parameters, while the PAFC model results were split, with increased displacement and decreased required fuel weight impact. (ASSET/MONOSC refers to the required fuel weight as "usable" fuel, meaning that amount of fuel which can be used. It recognizes the fact that some fuel at the tank bottoms cannot be used; this "usable" fuel, therefore, is the fuel required to achieve the endurance range). Tables 4-11, 4-12 and Figures 4-5 and 4-6 below detail the exact findings.

Model	Displacement (Ltons)	Change* in Displacement (Ltons)	% Difference
Baseline	3980.2	N/A	N/A
10.8 Mw PEMFC	3713.5	-266.7	6.70%
12.0 Mw PEMFC	3756.1	-224.1	5.63%
13.2 Mw PEMFC	3808.7	-171.5	4.31%
10.8 Mw MCFC	4405.9	425.7	10.69%
12.0 Mw MCFC	4430.0	449.8	11.30%
13.2 Mw MCFC	4661.7	681.5	17.12%
10.8 Mw PAFC	4152.5	172.3	4.33%
12.0 Mw PAFC	4216.1	235.9	5.93%
13.2 Mw PAFC	4313.3	333.1	8.37%

Table 4-11, Displacement Changes  
\*relative to baseline

Model	Required Fuel Weight (Ltons)	Change* in Required Fuel Weight (Ltons)	% Difference
Baseline	515.4	N/A	N/A
10.8 Mw PEMFC	472.3	-43.1	8.36%
12.0 Mw PEMFC	479.0	-36.4	7.06%
13.2 Mw PEMFC	484.5	-30.9	6.00%
10.8 Mw MCFC	567.3	51.9	10.07%
12.0 Mw MCFC	572.1	56.7	11.00%
13.2 Mw MCFC	588.7	73.3	14.22%
10.8 Mw PAFC	474.0	-41.4	8.03%
12.0 Mw PAFC	469.2	-46.2	9.96%
13.2 Mw PAFC	474.2	-41.2	7.99%

Table 4-12, Usable Fuel Weight Changes  
\*relative to baseline

It had been expected from the outset of the study that the superior efficiency of the molten carbonate cells would decrease the usable fuel weight required offsetting the increased weight of the fuel cell itself. This was not the case. The MCFC volume requirements forced the ship to be much larger than the baseline, thereby increasing the power required to achieve endurance speed, resulting in a greater usable fuel weight.



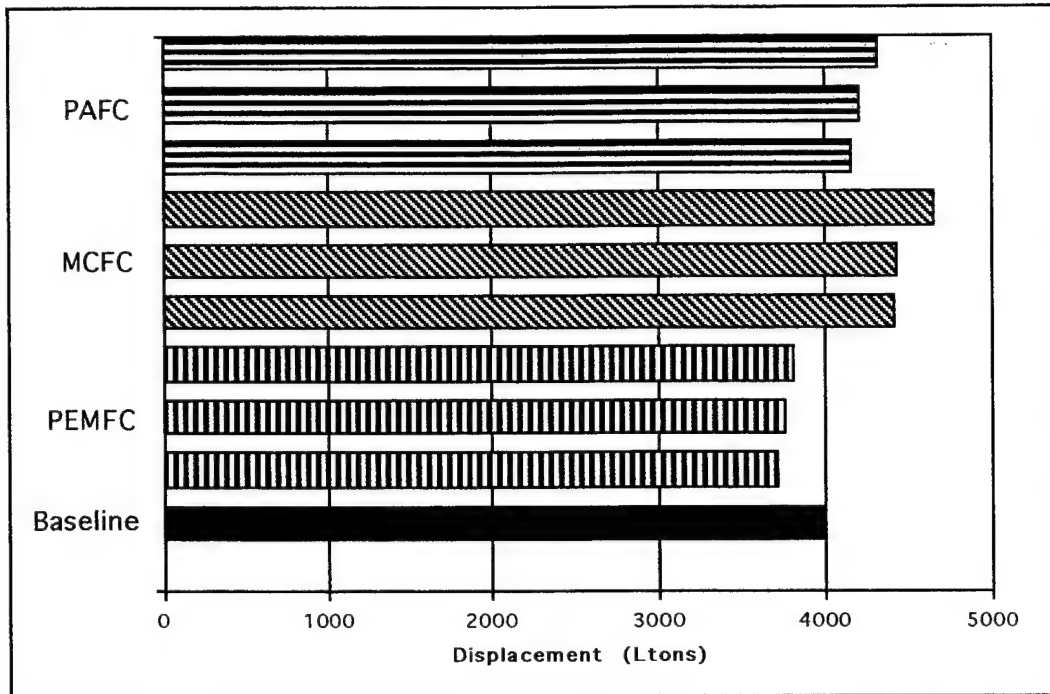


Figure 4-5, Displacement Comparison

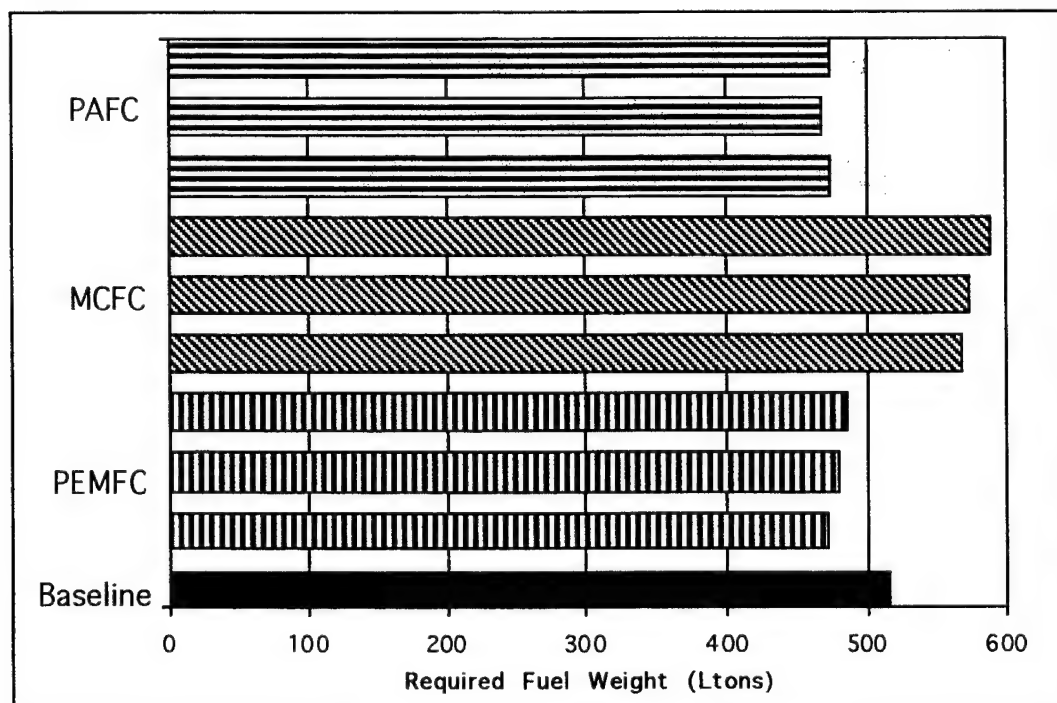


Figure 4-6, Required Fuel Weight Comparison

This should have occurred with the PAFC models as well. However, when the fuel cell characteristics are analyzed, it becomes evident that its half power (half of rated power) specific fuel consumption (SFC) is much less ( 0.4038 Lb/kW-hr vs. 0.4885 Lb/kW-hr). This is significant in that the half power SFC is what is used by ASSET/MONOSC to map fuel consumption. The MCFC is much more efficient than the PEMFC and baseline power plant (and nearly equal to the PAFC), but only at 100% power.

Another factor in the split results for the PAFC was the actual density of the powerplant. Its average power (net) density was 23.8 Lb/kW. This compares to 30.2 Lb/kW for the MCFC models. A smaller, lighter hull structure was required, even though it required 26-31% more volume (than the MCFC).

One result, which is not shown above, was the relation of ship size and installed power versus sustained speed. As mentioned before, three models of each cell type were constructed. One at approximately 90% baseline (shaft horsepower plus maximum marginal electric load), one at approximately 100%, and the other at approximately 110%. Sustained speed was left constant at 25.0 knots. In nearly every model, with the exception of the 110% (13.2 MW) models, the main engines were overloaded (unable to achieve sustained speed on 80% power) to varying degrees. This overload ranged from 8% to 16% on the PEMFCs, 16% to 27% on the MCFCs and 9% to 20% on the PAFC models. This was not expected for the PEMFC models as the displacement was lower than the

baseline. The most reasonable explanation for this comes from Principle of Naval Architecture. "From a resistance point of view, greater length for a given displacement will reduce the wave-making resistance but increase the frictional resistance, so that longer lengths will be beneficial in ships running at high speeds." (PNA 1988, p. 66)

Comparison of the hull characteristics between the baseline and the lower power PEMFC model shows nearly equivalent draft, depth, and coefficients of form, but the length to beam (L/B) ratios are slightly different, with the baseline L/B of 7.2 and PEMFC L/B of 7.34. Attempts to minimize the beam, through subsequent synthesis runs, were not successful, as convergence was not achieved. Increasing the length is an option, however, the required vs. allowable area balance was disrupted, resulting in a very small superstructure. A more sophisticated trade-off analysis would have to be done to optimize the design for a balance between length and superstructure size. The author does recognize however, that in most cases, a smaller superstructure is more desirable for a naval ship. This is due to the inherent "stealth" characteristics of a smaller superstructure (reduced radar cross section).

## V. CONCLUSIONS AND RECOMMENDATIONS

### A. CONCLUSIONS

The objectives of this study have been met. The results found correlate favorably with those of the previous ONR study. In both studies, high power density, low volume fuel cells produced the most favorable impacts on ship design. The use of ASSET/MONOSC as an advanced power plant modeling tool was successful, though it has limitations. The most significant limitation was the method of modeling the cells as diesel engines. The modularity advantages of fuel cells could not be fully exploited. Another limitation to this modeling is that the size of the fuel cell could not be scaled easily to produce an optimized design. This is due to the asymmetrical scaling qualities of the two components that comprised the "diesel" model: the fuel cell stacks and the balance of plant (supporting auxiliaries). Separate fuel cell characteristic models would have to be developed for each power level. Due to time and other constraints, this was not attempted.

Based on the findings of this study, several conclusions have been drawn.

- Use of fuel cells for propulsion and ship service power definitely impacts the displacement and required fuel weight.

- Proton exchange membrane fuel cells are the most desirable cell types from a ship impact point of view. However, viability questions in terms of large capacity research and development need to be addressed before committing to PEMFC's as the power source of choice.
- Phosphoric acid fuel cells show promise due to their high efficiency, yet will cause an increase in ship size. Technological issues such as CO intolerance, start time, service life and a hazardous electrolyte must be resolved before installation aboard a ship.
- Molten carbonate fuel cells did not favorably impact the ship due to their weight and volume requirements. They do offer several technological advantages such as high efficiency, CO tolerance, direct reforming capable, that might offset the weight and volume disadvantages in a large ship application.
- The issue of environmental impact, while not specifically modeled in this study, should weigh significantly on a ship designer's choice of power plant. Any of the three fuel cells investigated here offers substantial benefits when compared against a conventional engine or gas turbine.

## **B. RECOMMENDATIONS**

Several recommendations for the use of fuel cells and future study are drawn here:

- The U.S. Navy and U.S. Coast Guard should devote as much research and development funding as possible to fuel cells. The advantages of fuel cells are too overwhelming to ignore for future ship designs.
- Convert at least a portion of an existing ship's power plant to fuel cell power as part of the Advanced Technology Demonstrator (ATD) program (NAVY) or Ship Alteration Prototype program (CG) in the near future.
- Conduct a in-depth manning and maintenance analysis using existing (land-based) fuel cell power plants to accurately determine the reduction (or increase) in man-hours required to operate the ship.
- Investigate the use of fuel cells (especially MCFCs) on large scale combatants (CV, LHA) and auxiliaries (AD, AFS, AO, etc.), where the propulsion plant does not occupy a significant portion of the interior volume and operating speeds are not as variable as in smaller combatants.
- Further investigate the use of "Federated" compartment style ships, using multiple fuel cells, throughout the ship, as the power source.



## APPENDIX A. BASELINE MODEL SUMMARY

This appendix contains the summary reports of each module for the baseline ship. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.24.04.

PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	54.00
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-OPTIMUM	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	379.00	PRISMATIC COEF	0.570
LOA, FT	401.04	MAX SECTION COEF	0.795
BEAM, FT	52.64	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	57.29	LCB/LCP	0.515
DRAFT, FT	15.06	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.58	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.41	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.76	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	23.36	BARE HULL DISPL, LTON	3890.98
STABILITY BEAM, FT	52.64	AREA BEAM, FT	48.47

### BARE HULL DATA ON LWL

LGTH ON WL, FT	379.00
BEAM, FT	52.64
DRAFT, FT	15.05
FREEBOARD @ STA 3, FT	23.36
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	14648.84
WETTED SURFACE, FT2	19225.80
BARE HULL DISPL, LTON	3893.21
APPENDAGE DISPL, LTON	87.02
FULL LOAD WT, LTON	3980.21
HULL GEOM MODULE	2.125 CPU SECONDS.

### STABILITY DATA ON LWL

KB, FT	9.29
BMT, FT	18.00
KG, FT	21.43
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	5.27
GML, FT	845.54
GMT/B AVAIL	0.100
GMT/B REQ	0.100



ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.24.06.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-CALC

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	379.00	HULL AVG DECK HT, FT	11.51
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	474469.	NO TRANS BHDS	13
MR VOLUME, FT3	66410.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	28113.	NO MACHY RMS	2
EXCESS TANKAGE, FT3	9513.	NO PROP SHAFTS	2

ARR AREA LOST TANKS, FT2 25.6

HULL ARR AREA AVAIL, FT2 32445.6

HULL SUBDIV MODULE 0.625 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.24.06.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	379.00	DKHS LENGTH OA, FT	141.54
BEAM, FT	52.64	DKHS MAX WIDTH, FT	57.63
AREA BEAM, FT	48.47	DKHS HT (W/O PLTHS), FT	46.74

DKHS FWD LIMIT-	STA 4.0	OTHER ARR AREA REQ, FT2	35470.94
DKHS AFT LIMIT-	STA 11.5	HULL ARR AREA AVAIL, FT2	32445.57
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	5119.50
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	634.17
DKHS AVG SIDE ANG, DEG	10.00		

DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	11428.75
DKHS ARR AREA DERIV, FT2	171.33	DKHS ARR AREA AVAIL, FT2	8236.81
DKHS MIN ALW BEAM, FT	20.45	DKHS VOLUME, FT3	83478.04
BRIDGE L-O-S OVER BOW, FT	311.17		

		DKHS WEIGHT, LTON	160.45
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	41.06

DKHS SIDE ANG OFFSET, DEG

DKHS DECK HT OFFSET, FT

DECKHOUSE MODULE 1.250 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.24.08.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT  
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

----- HULL STRENGTH AND STRESS -----

HOGGING BM, FT-LTON	67271.	PRIM STRESS KEEL-HOG, KSI	13.04
SAGGING BM, FT-LTON	56083.	PRIM STRESS KEEL-SAG, KSI	10.87
MIDSHIP MOI, FT2-IN2	193441.	PRIM STRESS DECK-HOG, KSI	13.45
DIST N.A. TO KEEL, FT	16.74	PRIM STRESS DECK-SAG, KSI	11.21
DIST N.A. TO DECK, FT	17.27	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN2	11556.	SEC MOD TO DECK, FT-IN2	11202.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	4	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		13

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	841.5	20.89
110	SHELL+SUPPORT	395.4	15.64
120	HULL STRUCTURAL BHD	108.8	20.05
130	HULL DECKS	266.2	30.84
140	HULL PLATFORM/FLATS	71.2	14.12
HULL STRUCT MODULE		1.625 CPU SECONDS.	

ASSET/MONOSC VERSION 3.3+ - APPENDAGE MODULE - 5/31/96 08.24.10.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 87.0

SHELL DISP, LTON 14.9

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	12.3	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8879	AVG RUDDER CHORD, FT	6.88
SKEG THK, FT	1.00	RUDDER THK, FT	1.04
SKEG PROJECTED AREA, FT2	429.6	RUDDER SPAN, FT	16.94
		RUDDER PROJECTED AREA, FT2	116.6
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	3.5
BILGE KEEL DISP, LTON	5.8		
BILGE KEEL LGTH, FT	89.54	FIN SIZE IND	GIVEN

SHAFT SUPPORT TYPE IND	POD	NO FIN PAIRS	1
SHAFT SUPPORT DISP, LTON	44.1	FWD FIN	
SHAFT DISP, LTON	0.0	CHORD, FT	10.35
		THK, FT	1.55
		SPAN, FT	9.05
PROP TYPE IND	FP	PROJECTED AREA, FT2	93.7
PROP BLADE DISP, LTON	0.8	DISP, LTON (PER PAIR)	5.5
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	11.65	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.625 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.24.11.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	3980.2	CORR ALW	0.00050
AVG ENDUR DISP, LTON	3758.7	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	515.4	TRAILSHAFT PWR FAC	0.00
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.185
NO PROP SHAFTS	2.	SUSTN SPEED	0.204
PROP DIA, FT	11.65	ENDUR SPEED	0.405

CONDITION	SPEED-----KT	FRIC	RESID	APPDGE	WIND	MARGIN	TOTAL	DRAG LBF
MAX	26.05	5856.	8584.	3612.	256.	1465.	19774.	247399.
SUSTN	25.00	5199.	6282.	3143.	227.	1188.	16038.	209055.
ENDUR	14.00	941.	431.	682.	40.	168.	2261.	52636.
RESISTANCE MODULE				1.375 CPU SECONDS.				

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.24.13.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL
MAX SPEED, KT	26.05	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	9887.	ENDUR EHP (/SHAFT), HP	1131.

MAX SHP (/SHAFT), HP	14213.	ENDUR SHP (/SHAFT), HP	1568.
MAX PROP RPM	220.0	ENDUR PROP RPM	109.9
MAX PROP EFF	0.696	ENDUR PROP EFF	0.721

SUSTN SPEED, KT	25.00	PROP DIA, FT	11.65
SUSTN EHP (/SHAFT), HP	8019.	NO BLADES	7.
SUSTN SHP (/SHAFT), HP	11392.	PITCH RATIO	1.26
SUSTN PROP RPM	206.6	EXPAND AREA RATIO	0.922
SUSTN PROP EFF	0.704	CAVITATION NO	1.66

NO PROP SHAFTS 2.0

TOTAL PROPELLER WT, LTON 14.22  
PROPELLER MODULE 1.125 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.24.15.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	26.05
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2698.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1137.	USABLE FUEL WT, LTON	515.4
SWBS 200 GROUP WT, LTON	281.5	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	270.4		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	2941. KW	2	2	1
VSCF SS CYCLO	KW	0	0	0

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	GE-LM1600-VAN2		A-12V270
ENG TYPE IND	RGT		D DIESEL
ENG SIZE IND	CALC		CALC
NO INSTALLED	2	0	2
ENG PWR AVAIL, HP	15769.		4104.
ENG RPM	4539.5		900.0
ENG SFC, LBM/HP-HR	0.345		.335
ENG LOAD FRAC	1.000		1.000
MACHINERY MODULE	2.875 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.24.17.

PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	379.0	TOTAL ACCOM	122.0
BEAM, FT	52.6	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	40682.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	557947.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	515.4	WATER HTR TYPE IND	INSTANT
FULL LOAD WT, LTON	3980.2	ANCHOR LOC IND	BOTTOM
MAX SHP, HP	31538.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 5882.6 KW

TOTAL AIRCOND LOAD, TON	166.5	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT, LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT, LTON	0.3

BOAT SELECT IND	GIVEN		
BOAT TYPE IND	MIXED		
BOAT COMPLEMENT	2 RIB+UB/UB	NO FAS STATIONS	2.
SWBS 583 WT, LTON	35.6	RAS STATIONS:	NO TYPE
			2.

BULKHEAD

STRIKE GEAR:	NO	TYPE	SSCS 3.53 AREA, FT2	253.5
	2.	PALLET	SWBS 571 WT, LTON	10.7

STRK DECK AREA, FT2	475.3	STOWAGE AREA, FT2	2362.5
SWBS 572 WT, LTON	37.3	SWBS 671 WT, LTON	4.1
		SWBS 672 WT, LTON	26.2

AUXILIARY SYS MODULE 1.875 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.24.19.  
PRINTED REPORT NO. 1 - SUMMARY

SWBS	G R O U P	W E I G H T		LCG	VCG	RESULTANT ADJ	
		LTON	PER CENT	FT	FT	WT-LTON	VCG-FT
100	HULL STRUCTURE	1353.4	34.0	185.06	22.97	1.0	.00
200	PROP PLANT	281.5	7.1	249.69	14.83		
300	ELECT PLANT	270.4	6.8	198.22	18.55		
400	COMM + SURVEIL	135.1	3.4	144.02	27.58	82.6	.54
500	AUX SYSTEMS	542.4	13.6	208.45	23.03	20.0	.20
600	OUTFIT + FURN	331.0	8.3	189.50	22.37		
700	ARMAMENT	20.7	0.5	170.55	37.44	16.2	.16
M11	D+B WT MARGIN	366.7	9.2	195.30	22.05		

D+B KG MARGIN				+	2.76
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L I G H T S H I P	3301.1	82.9	195.30	24.80	119.8	.91
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F00	FULL LOADS	679.1	17.1	194.61	5.03	85.0	.22
F10	CREW + EFFECTS	13.0		178.13	25.90		
F20	MISS REL EXPEN	21.2		166.76	12.17		
F30	SHIPS STORES	17.4		204.66	19.43		
F40	FUELS + LUBRIC	609.4		196.01	3.93		
F50	FRESH WATER	18.1			4.88		
F60	CARGO						
M24	FUTURE GROWTH						

FULL LOAD WT	3980.2	100.0	195.19	21.42	204.8	1.14
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WEIGHT MODULE 1.875 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.24.20.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	3980.2	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	11.51	AC MARGIN FAC	0.200
MR VOLUME, FT3	66410.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
DKHS ONLY	1591.0	5119.3	8236.8	83478.
HULL OR DKHS	2670.0	35471.1	32445.6	474469.
TOTAL	4261.0	40590.4	40682.4	557947.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
1.	MISSION SUPPORT	5663.6	2235.8	14.0
2.	HUMAN SUPPORT	7923.7	381.5	19.5
3.	SHIP SUPPORT	13124.2	1299.7	32.3
4.	SHIP MOBILITY SYSTEM	11945.9	958.4	29.4
5.	UNASSIGNED	1932.9	243.8	4.8
	TOTAL	40590.4	5119.3	100.0

SPACE MODULE 1.750 CPU SECONDS.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

Baseline Design

PRINCIPAL CHARACTERISTICS - FT  
 LBP 379.0  
 LOA 401.0  
 BEAM, DWL 52.6  
 BEAM, WEATHER DECK 57.3  
 DEPTH @ STA 10 34.0  
 DRAFT TO KEEL DWL 15.1  
 DRAFT TO KEEL LWL 15.1  
 FREEBOARD @ STA 3 23.4  
 GMT 5.3  
 CP 0.570  
 CX 0.795

SPEED(KT): MAX= 26.0 SUST= 25.0  
 ENDURANCE: 8000.0 NM AT 14.0 KTS

TRANSMISSION TYPE: ELECT  
 MAIN ENG: 2 RGT @ 15769.1 HP

SHAFT POWER/SHAFT: 14213.2 HP  
 PROPELLERS: 2 - FP - 11.6 FT DIA

SEP GEN: 2 D DIESEL @ 2941.3 KW

24 HR LOAD 1136.5  
 MAX MARG ELECT LOAD 2698.4

	OFF	CPO	ENL	TOTAL
MANNING	15	13	82	110
ACCOM	17	15	90	122

WEIGHT SUMMARY - LTON  
 GROUP 1 - HULL STRUCTURE 1353.4  
 GROUP 2 - PROP PLANT 281.5  
 GROUP 3 - ELECT PLANT 270.4  
 GROUP 4 - COMM + SURVEIL 135.1  
 GROUP 5 - AUX SYSTEMS 542.4  
 GROUP 6 - OUTFIT + FURN 331.0  
 GROUP 7 - ARMAMENT 20.7

SUM GROUPS 1-7 2934.4  
 DESIGN MARGIN 366.7

LIGHTSHIP WEIGHT 3301.1  
 LOADS 679.1

FULL LOAD DISPLACEMENT 3980.2  
 FULL LOAD KG: FT 21.4

MILITARY PAYLOAD WT - LTON 201.5  
 USABLE FUEL WT - LTON 515.4

AREA SUMMARY - FT2  
 HULL AREA - 32445.6  
 SUPERSTRUCTURE AREA - 8236.8

TOTAL AREA 40682.4

VOLUME SUMMARY - FT3  
 HULL VOLUME - 474468.9  
 SUPERSTRUCTURE VOLUME - 83478.0

TOTAL VOLUME 557947.0

PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
TOTAL	99.	11.	0.	110.	122.

PRINTED REPORT NO. 3 - INDICATORS

MISSION

DESIGN MODE IND-ENDURANCE  
 ENDUR DISP IND -AVG DISP  
 ENDUR DEF IND -USN  
 SUSTN SPEED IND-GIVEN  
 ENDUR SPEED IND-GIVEN  
 HULL FORM FACTORS  
 HULL OFFSETS IND-GENERATE  
 HULL DIM IND -B+T  
 HULL BOUNDARY CONDITIONS  
 HULL BC IND -CONV DD  
 HULL STA IND -OPTIMUM  
 SHELL APPENDAGES  
 BILGE KEEL IND -PRESENT  
 SKEG IND -PRESENT  
 MARGIN LINE  
 MARGIN LINE IND-CALC  
 HULL SUBDIVISION FACTORS  
 HULL SUBDIV IND-CALC  
 INNER BOTTOM  
 INNER BOTTOM IND-PRESENT  
 HULL LOADS  
 HULL LOADS IND -CALC  
 SHOCK FNDTN IND-SHOCK  
 STRUCTURAL ARRANGEMENT  
 BOT PLATE LIMIT IND-CALC  
 STIFFENERS  
 STIFFENER SHAPE IND-CALC  
 DKHS GEOM FACTORS  
 DKHS GEOM IND -GENERATE  
 DKHS SIZE IND -AUTO X  
 DKHS MATERIALS  
 DKHS MTRL TYPE IND-HTS  
 FIRE PROTECT IND -NONE  
 DKHS LOADS  
 BLAST RESIST IND-7 PSI  
 ARRANGEMENT TYPES  
 MECH CL ARR IND -  
 MECH PORT ARR IND -  
 MECH STBD ARR IND -  
 ELECT PG ARR 1 IND-M-PG  
 ELECT PG ARR 2 IND-  
 ELECT DL ARR IND -MTR  
 ARRANGEMENT CG  
 MACHY KG IND -CALC  
 ENGINE CONFIG FACTORS  
 ENG ENDUR RPM IND -CALC  
 SEC ENG USAGE IND -  
 ENDUR CONFIG IND -NO TS  
 GT ENG ENCL IND -84 DBA  
 DIESEL ENG MOUNT IND-COMPOUND  
 MAIN ENGINES

GEARS

SEC ENG 2 SPD GEAR IND-  
 GEAR IMPED MASS IND -PRESENT  
 PROPULSION SHAFTING  
 SHAFT SUPPORT TYPE IND-POD  
 SHAFT SYS SIZE IND -CALC  
 PROPULSION SHAFT BEARING  
 THRUST BRG LOC IND-CALC  
 PROPELLER FACTORS  
 PROP TYPE IND -FP  
 PROP SERIES IND-ANALYTIC  
 PROP DIA IND -CALC  
 PROP AREA IND -CALC  
 PROP LOC IND -CALC  
 PITCH RATIO IND-CALC  
 OPEN WATER PROP DATA  
 PROP ID IND -  
 PROPULSION SUPPORT SYS  
 INLET TYPE IND -PLENUM  
 DUCT SILENCING IND -BOTH  
 EXHAUST IR SUPP IND-PRESENT  
 SS GENERATOR FACTORS  
 SS SYS TYPE IND-SEP  
 FREQ CONV IND -  
 SS GENERATOR SIZE  
 SS GEN SIZE IND-NON STD  
 SS ENGINES  
 SS ENG SELECT IND -GIVEN  
 SS ENG MODEL IND -A-12V270  
 SS ENG TYPE IND -D DIESEL  
 SS ENG SFC EQN IND-DIESEL  
 SS ENG SIZE IND -CALC  
 SONAR SYSTEM  
 SONAR DOME IND -NONE  
 SONAR DRAG IND -  
 CLIMATE CONTROL

COLL PROTECT SYS IND-PRESENT  
 REFER MACHY LOC IND -  
 AUX BOILER TYPE IND -ELECTRIC  
 SEA WATER SYSTEMS

AIR AND MISC FLUID SYSTEM

RUDDERS

RUDDER SIZE IND-CALC  
 RUDDER TYPE IND-INTEGRAL  
 ROLL FINS  
 FIN SIZE IND -GIVEN  
 REPLENISHMENT SYSTEMS



MAIN ENG SELECT IND-GIVEN		SPECIAL PURPOSE SYSTEMS	
MAIN ENG MOD IND -GE-LM1600-VAN2		POLLUTION CNTL IND-PRESENT	
MAIN ENG TYPE IND -RGT		OUTFIT AND FURNISHINGS	
MAIN ENG SFC EQ IND-POLY QN		UNIT CMDR IND -NONE	
MAIN ENG SIZE IND -CALC			
SEC ENGINES			
SEC ENG SELECT IND -		FUELS AND LUBRICANTS	
SEC ENG MODEL IND -		SHIP FUEL TYPE IND-JP-5	
SEC ENG TYPE IND -		RESISTANCE FACTORS	
SEC ENG SFC EQN IND-		FRICTION LINE IND -ITTC	
SEC ENG SIZE IND -		RESID RESIST IND -NRC	
TRANSMISSION FACTORS		WORM CURVE IND -DD CALC	
TRANS TYPE IND -ELECT		PRPLN SYS RESIST IND-CALC	
TRANS EFF IND -CALC		SHIP WEIGHT	
ELECTRICAL TRANSMISSION		SHIP LCG INPUT IND-CALC	
ELECT PRPLN TYPE IND -ACR-DCS			
ELECT PRPLN RATIND IND-CALC			
AC SYNC ROTOR COOL IND-AIR			
TRANS LINE NODE PT IND-CALC			
SWITCHGEAR TYPE IND -ADV			
PRINTED REPORT NO. 4 - MARGINS			
HULL			
MIN FREEBOARD MARGIN, FT	.25		
HULL MARGIN STRESS, KSI	2.24		
PROPULSION PLANT			
TORQUE MARGIN FAC	1.200		
ELECTRIC PLANT			
ELECT LOAD DES MARGIN FAC	.200		
ELECT LOAD SL MARGIN FAC	.100		
AUXILIARY SYSTEMS			
AC MARGIN FAC	.200		
OUTFIT AND FURNISHINGS			
CREW ACCOM MARGIN FAC	.100		
WEIGHT MARGINS			
GROWTH WT MARGIN, LTON	.0		
D+B WT MARGIN, LTON	.0		
D+B WT MARGIN FAC	.125		
D+B KG MARGIN, FT	.00		
D+B KG MARGIN FAC	.125		
RESISTANCE FACTORS			
DRAG MARGIN FAC	.080		
SPACE FACTORS			
SPACE MARGIN FAC	.050		
PASSWAY MARGIN FAC	.000		
TANKAGE MARGIN FAC	.000		

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW	PAYLOAD AND ADJUSTMENT NAME
1	CIC COMMAND AND DECISION MODFIG
2	EXCOMM (1/2 DDG51)
3	NAV SYS (1/2 DDG 51)
4	SPS-67 SSR
5	SPY-3C (MINI-SPY)
6	MK XII AIMS IFF
8	SLQ-25 NIXIE
9	SLQ-32(V)3 ACTIVE/PASSIVE ECM
11	CS HOLD UP BATTERY
12	SENSOR COOLING SYSTEMS
13	HELO HANGAR
14	CRANE
15	BALLAST
16	OPER READINESS AND TEST SYS
17	RAST/TALON HELO COMBO
18	RAST CONTROL STATION
19	LAMPS MKIV: AVIATION SUPPORT & SPARES
21	1X 40MM CIWS/MULTI PURP GUN
22	1X 40MM CIWS/MULTI PURP GUN
23	21 CELL RAM LAUNCHER
24	LONGITUDNAL BULKHEADS AROUND MAGAZINE
26	40MM AMMO (MIXED) 3000 RNDs
27	40MM AMMO (MIXED) -- 3000 RNDs
29	HELO AS565 PANTHER: (DOLPHIN)
30	LAMPS MKIII: FUEL [JP-5]
32	ADMIN LAN
34	AVIATION STORES
36	MINE DETECTION HULL MOUNTED SONAR

ROW	WT KEY	WT ADD LTON	WT FAC	VCg KEY	VCg ADD FT	VCg FAC
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W588	10.00	.000	BL	40.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000
15	W191	1.00	.000	BL	1.00	1.000
16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000

22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000

AREA	---AREA ADD, FT2---	-----AREA FAC-----			
ROW	KEY	HULL/SS	SS/ONLY	HULL/SS	SS/ONLY
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	A1312	.00	600.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

KW	-----KW ADD, KW-----	-----KW FAC-----					
ROW	KEY	W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000

13	NONE	5.00	10.00	5.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000
17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000



## APPENDIX B. FUEL CELL DIESEL MODELING DETAILS

The instructions below detail the adjustments to the data that need to be accomplished to successfully model fuel cells in ASSET/MONOSC. This was taken from an internal NAVSEA memorandum from Code 802 to Code 263 dated 03 February 1993.

1. Set indicators to specify the calculational path:

- MAIN ENG SELECT IND = GIVEN
- MAIN ENG TYPE IND = D DIESEL
- MAIN ENG MODEL IND = OTHER
- MAIN ENG SIZE IND = GIVEN
- DIESEL ENG MOUNT IND = NONE
- EXHAUST IR SUPPRESS IND = NONE
- ENG ENDUR RPM IND = CALC
- TRANS EFF IND = GIVEN
- ELECT PRPLN RATING IND = GIVEN

2. Eliminate the IPS propulsion generator:

- ELECT PRPLN RATING ARRAY (1,1) = 0.00001
- ELECT PRPLN ADJ FAC ARRAY (1,1) = 0.00001
- ELECT PRPLN ADJ FAC ARRAY (2,1) = 0.00001
- ELECT PRPLN ADJ FAC ARRAY (3,1) = 0.00001
- ELECT PRPLN ADJ FAC ARRAY (4,1) = 0.00001

3. Size motor:

- ELECT PRPLN RATING ARRAY (2,1) = (Nmot/Nfc)\*Mwfc

Nmot = number of motors  
Nfc = number of fuel cells  
Mwfc = fuel cell MW rating

- ELECT PRPLN ADJ FAC ARRAY (1,2) = 1.0
- ELECT PRPLN ADJ FAC ARRAY (2,2) = 1.0
- ELECT PRPLN ADJ FAC ARRAY (3,2) = 1.0
- ELECT PRPLN ADJ FAC ARRAY (4,2) = 1.0

4. Eliminate the IPS dc propulsion rectifiers:

- SEC ENG SFC FAC ARRAY (9,1) = 0.00001
- SEC ENG SFC FAC ARRAY (10,1) = 0.00001

5. Use MAIN ENGINES to simulate the fuel cell, basing the SFC on the 50% power condition:

- MAIN ENG PWR AVAIL = 1341\*Mwfc ...hp
- MAIN ENG SFC = .7457\*(SFCfc @ 50%)/.9831 ...lb/hp-hr
- MAIN ENG RPM = 3600 ...rpm
- MAIN ENG EXHAUST TEMP = as indicated ...degF

- MAIN ENG BARE WT = WGTfc + WGTbop ...Lton
- MAIN ENG DIM ARRAY (1,1) = (VOLfc+VOLbop)/(W\*H) ...ft
- MAIN ENG DIM ARRAY (2,1) = (VOLfc+VOLbop)/(L\*H) ...ft
- MAIN ENG DIM ARRAY (3,1) = H ...ft
- MAIN ENG MASS FLOW = as indicated \* 0.75 ...lb/s

WGTfc = Weight of fuel cell

WGTbop = Weight of balance of plant

VOLfc = Volume of fuel cell

VOLbop = Volume of balance of plant

6. Increase the transmission efficiency due to removal of the IPS propulsion generators & rectifiers:

- TRANS EFF ARRAY (1,1) = EFFd/.968
- TRANS EFF ARRAY (2,1) = EFFc/.963

where EFFd and EFFc are the full power and 25% power transmission efficiencies of the IPS reference design.

7. Reduce the size of the unnecessary "diesel" portion of the lube oil system:

- Put in a weight adjustment of -W262(diesel) for SWBS 262 in PAYLOAD AND ADJUSTMENTS where:

$$W262(\text{diesel}) = 5.0 * (Nfc * MWfc)^{.5} \quad \dots \text{Lton}$$

8. Adjust the size of the fuel oil service system to account for the desulfurizer equipment:

- Put in weight and area adjustment values as indicated for SWBS 261 in PAYLOAD AND ADJUSTMENTS.

9. To insure that duct volume requirements are properly calculated, set the top of each fuel cell machinery room to the deck above the fuel cell using: MR UPR DECK ID ARRAY(10,1)

## APPENDIX C. 10.8 MEGAWATT PEMFC MODEL SUMMARY

This appendix contains the summary reports of each module for the 90% power PEMFC model. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.25.02.

PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	50.70
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-OPTIMUM	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	370.00	PRISMATIC COEF	0.570
LOA, FT	391.95	MAX SECTION COEF	0.795
BEAM, FT	50.37	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	55.03	LCB/LCP	0.515
DRAFT, FT	15.02	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.45	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.33	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.74	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	23.31	BARE HULL DISPL, LTON	3625.42
STABILITY BEAM, FT	50.37	AREA BEAM, FT	47.62

### BARE HULL DATA ON LWL

LGTH ON WL, FT	370.00
BEAM, FT	50.37
DRAFT, FT	15.01
FREEBOARD @ STA 3, FT	23.32
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	13684.11
WETTED SURFACE, FT2	18219.14
BARE HULL DISPL, LTON	3627.50
APPENDAGE DISPL, LTON	85.98
FULL LOAD WT, LTON	3713.48
HULL GEOM MODULE	2.125 CPU SECONDS.

### STABILITY DATA ON LWL

KB, FT	9.26
BMT, FT	16.50
KG, FT	21.12
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	4.03
GML, FT	806.93
GMT/B AVAIL	0.080
GMT/B REQ	0.080



ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.25.04.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	370.00	HULL AVG DECK HT, FT	11.39
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	444234.	NO TRANS BHDS	13
MR VOLUME, FT3	23085.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	26074.	NO MACHY RMS	3
EXCESS TANKAGE, FT3	6416.	NO PROP SHAFTS	2
ARR AREA LOST TANKS, FT2	26.3		
HULL ARR AREA AVAIL, FT2	34410.8		
HULL SUBDIV MODULE	0.750 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.25.05.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	370.00	DKHS LENGTH OA, FT	151.52
BEAM, FT	50.37	DKHS MAX WIDTH, FT	55.35
AREA BEAM, FT	47.62	DKHS HT (W/O PLTHS), FT	46.63
DKHS FWD LIMIT- STA	4.0	OTHER ARR AREA REQ, FT2	37819.88
DKHS AFT LIMIT- STA	12.2	HULL ARR AREA AVAIL, FT2	34410.84
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	4921.69
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	597.90
DKHS AVG SIDE ANG, DEG	10.00		
DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	10710.60
DKHS ARR AREA DERIV, FT2	183.22	DKHS ARR AREA AVAIL, FT2	8422.25
DKHS MIN ALW BEAM, FT	20.39	DKHS VOLUME, FT3	85374.41
BRIDGE L-O-S OVER BOW, FT	303.24		
		DKHS WEIGHT, LTON	164.09
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	40.83
DKHS SIDE ANG OFFSET, DEG			
DKHS DECK HT OFFSET, FT			
DECKHOUSE MODULE	1.250 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.25.06.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT  
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

----- HULL STRENGTH AND STRESS -----			
HOGGING BM, FT-LTON	60613.	PRIM STRESS KEEL-HOG, KSI	12.28
SAGGING BM, FT-LTON	50533.	PRIM STRESS KEEL-SAG, KSI	10.23
MIDSHIP MOI, FT <sup>2</sup> -IN <sup>2</sup>	185976.	PRIM STRESS DECK-HOG, KSI	12.55
DIST N.A. TO KEEL, FT	16.81	PRIM STRESS DECK-SAG, KSI	10.47
DIST N.A. TO DECK, FT	17.19	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN <sup>2</sup>	11061.	SEC MOD TO DECK, FT-IN <sup>2</sup>	10816.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	4	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		13

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	821.3	20.75
110	SHELL+SUPPORT	381.3	15.67
120	HULL STRUCTURAL BHD	105.5	19.94
130	HULL DECKS	253.0	30.75
140	HULL PLATFORM/FLATS	81.6	14.54
HULL STRUCT MODULE		1.875 CPU SECONDS.	

ASSET/MONOSC VERSION 3.3+ - APPENDAGE MODULE - 5/31/96 08.25.08.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 86.0

SHELL DISP, LTON 14.4

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	11.8	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8864	AVG RUDDER CHORD, FT	6.72
SKEG THK, FT	1.00	RUDDER THK, FT	1.00
SKEG PROJECTED AREA, FT <sup>2</sup>	413.0	RUDDER SPAN, FT	16.89
		RUDDER PROJECTED AREA, FT <sup>2</sup>	113.6
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	3.4
BILGE KEEL DISP, LTON	5.5		
BILGE KEEL LGTH, FT	87.41	FIN SIZE IND	GIVEN

SHAFT SUPPORT TYPE IND	POD	NO FIN PAIRS	1
SHAFT SUPPORT DISP, LTON	44.5	FWD FIN	
SHAFT DISP, LTON	0.0	CHORD, FT	11.16
		THK, FT	1.67
		SPAN, FT	7.76
PROP TYPE IND	FP	PROJECTED AREA, FT2	86.6
PROP BLADE DISP, LTON	0.8	DISP, LTON (PER PAIR)	5.5
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	11.60	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.625 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.25.10.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	3713.5	CORR ALW	0.00050
AVG ENDUR DISP, LTON	3510.4	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	472.3	TRAILSHAFT PWR FAC	0.00
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.191
NO PROP SHAFTS	2.	SUSTN SPEED	0.212
PROP DIA, FT	11.60	ENDUR SPEED	0.434

CONDITION	SPEED	EFFECTIVE HORSEPOWER, HP						DRAG
	KT	FRIC	RESID	APPDG	WIND	MARGIN	TOTAL	LBF
MAX	25.98	5521.	8586.	3604.	244.	1436.	19391.	243233.
SUSTN	25.00	4937.	6283.	3149.	217.	1167.	15754.	205344.
ENDUR	14.00	894.	391.	678.	39.	160.	2161.	50307.
RESISTANCE MODULE				1.250 CPU SECONDS.				

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.25.11.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL
MAX SPEED, KT	25.98	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	9695.	ENDUR EHP (/SHAFT), HP	1081.

MAX SHP (/SHAFT), HP	13918.	ENDUR SHP (/SHAFT), HP	1492.
MAX PROP RPM	220.0	ENDUR PROP RPM	109.3
MAX PROP EFF	0.697	ENDUR PROP EFF	0.724
SUSTN SPEED, KT	25.00	PROP DIA, FT	11.60
SUSTN EHP (/SHAFT), HP	7877.	NO BLADES	7.
SUSTN SHP (/SHAFT), HP	11165.	PITCH RATIO	1.26
SUSTN PROP RPM	206.9	EXPAND AREA RATIO	0.914
SUSTN PROP EFF	0.706	CAVITATION NO	1.67
NO PROP SHAFTS	2.0		
TOTAL PROPELLER WT, LTON	13.91		
PROPELLER MODULE	1.000 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.25.13.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	25.98
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2708.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1138.	USABLE FUEL WT, LTON	472.3
SWBS 200 GROUP WT, LTON	313.8	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	137.9		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	1777. KW	1	0	0
VSCF SS CYCLO	2974. KW	2	2	1

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	OTHER		MTU-12V538
ENG TYPE IND	D DIESEL		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	2	0	1
ENG PWR AVAIL, HP	14554.		2480.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.333		.343
ENG LOAD FRAC	1.165		1.000
MACHINERY MODULE	2.625 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.25.15.

PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	370.0	TOTAL ACCOM	122.0
BEAM, FT	50.4	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	42833.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	529609.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	472.3	WATER HTR TYPE IND	INSTANT
FULL LOAD WT, LTON	3713.5	ANCHOR LOC IND	BOTTOM
MAX SHP, HP	29108.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 1776.9 KW

PD GEN: VSCF @ 5948.0 KW

TOTAL AIRCOND LOAD, TON	165.4	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT, LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT, LTON	0.3

BOAT SELECT IND	GIVEN		
BOAT TYPE IND	MIXED		
BOAT COMPLEMENT	2 RIB+UB/UB	NO FAS STATIONS	2.
SWBS 583 WT, LTON	35.6	RAS STATIONS:	NO TYPE
		2.	BULKHEAD

STRIKE GEAR:	NO	TYPE	SSCS 3.53 AREA, FT2	212.9
2.		PALLET	SWBS 571 WT, LTON	10.7

STRK DECK AREA, FT2	429.6	STOWAGE AREA, FT2	1448.2
SWBS 572 WT, LTON	37.0	SWBS 671 WT, LTON	2.1
		SWBS 672 WT, LTON	13.1

AUXILIARY SYS MODULE 2.250 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.25.17.

PRINTED REPORT NO. 1 - SUMMARY

SWBS	G R O U P	W E I G H T		LCG	VCG	RESULTANT ADJ	
		LTON	P E R C E N T	FT	FT	WT-LTON	VCG-FT
100	HULL STRUCTURE	1266.5	34.1	183.18	23.13	1.0	.00
200	PROP PLANT	313.8	8.5	269.78	9.51		
300	ELECT PLANT	137.9	3.7	328.43	23.55		
400	COMM + SURVEIL	132.7	3.6	140.60	27.65	83.0	.59
500	AUX SYSTEMS	541.6	14.6	203.50	23.26	20.0	.22
600	OUTFIT + FURN	310.1	8.3	185.00	22.60		
700	ARMAMENT	20.6	0.6	166.50	37.44	16.2	.17
M11	D+B WT MARGIN	340.3	9.2	202.56	21.88		
	D+B KG MARGIN			+	2.74		
=====							
L I G H T S H I P		3063.6	82.5	202.56	24.61	120.2	.98
=====							

F00	FULL LOADS	649.9	17.5	133.94	4.69	85.0	.24
F10	CREW + EFFECTS	13.0		173.90	25.88		
F20	MISS REL EXPEN	21.2		162.80	12.16		
F30	SHIPS STORES	17.4		199.80	19.41		
F40	FUELS + LUBRIC	580.2		128.63	3.49		
F50	FRESH WATER	18.1			4.88		
F60	CARGO						
M24	FUTURE GROWTH						

=====	
FULL LOAD WT	3713.5 100.0 190.55 21.12 205.2 1.22
=====	
WEIGHT MODULE	1.500 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.25.18.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	3713.5	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	11.39	AC MARGIN FAC	0.200
MR VOLUME, FT3	23085.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
	-----	-----	-----	-----
DKHS ONLY	1591.0	4922.0	8422.2	85374.
HULL OR DKHS	2670.0	37819.7	34410.8	444234.
	-----	-----	-----	-----
TOTAL	4261.0	42741.7	42833.1	529609.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
		-----	-----	-----
	1. MISSION SUPPORT	5604.2	2198.9	13.1
	2. HUMAN SUPPORT	7923.7	381.5	18.5
	3. SHIP SUPPORT	11727.8	1301.2	27.4
	4. SHIP MOBILITY SYSTEM	15450.6	805.9	36.1
	5. UNASSIGNED	2035.3	234.4	4.8
		-----	-----	-----
	TOTAL	42741.7	4922.0	100.0
SPACE MODULE		1.500 CPU SECONDS.		

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PROTON EXCHANGE MEMBRANE

10.8 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT

LBP	370.0
LOA	392.0
BEAM, DWL	50.4
BEAM, WEATHER DECK	55.0
DEPTH @ STA 10	34.0
DRAFT TO KEEL DWL	15.0
DRAFT TO KEEL LWL	15.0
FREEBOARD @ STA 3	23.3
GMT	4.0
CP	0.570
CX	0.795

SPEED(KT): MAX= 26.0 SUST= 25.0  
ENDURANCE: 8000.0 NM AT 14.0 KTS

TRANSMISSION TYPE: ELECT  
MAIN ENG: 2 D DIESEL @ 14553.9 HP

SHAFT POWER/SHAFT: 13918.0 HP  
PROPELLERS: 2 - FP - 11.6 FT DIA

SEP GEN: 1 F DIESEL @ 1776.9 KW  
PD GEN: 2 VSCF @ 2974.0 KW

24 HR LOAD 1138.2  
MAX MARG ELECT LOAD 2708.0

	OFF	CPO	ENL	TOTAL
MANNING	15	13	82	110
ACCOM	17	15	90	122

WEIGHT SUMMARY - LTON

GROUP 1 - HULL STRUCTURE	1266.5
GROUP 2 - PROP PLANT	313.8
GROUP 3 - ELECT PLANT	137.9
GROUP 4 - COMM + SURVEIL	132.7
GROUP 5 - AUX SYSTEMS	541.6
GROUP 6 - OUTFIT + FURN	310.1
GROUP 7 - ARMAMENT	20.6

SUM GROUPS 1-7 2723.3  
DESIGN MARGIN 340.3

LIGHTSHIP WEIGHT 3063.6  
LOADS 649.9

FULL LOAD DISPLACEMENT 3713.5  
FULL LOAD KG: FT 21.1

MILITARY PAYLOAD WT - LTON 201.5  
USABLE FUEL WT - LTON 472.3

AREA SUMMARY - FT2

HULL AREA	-	34410.8
SUPERSTRUCTURE AREA	-	8422.2

TOTAL AREA 42833.1

VOLUME SUMMARY - FT3

HULL VOLUME	-	444234.3
SUPERSTRUCTURE VOLUME	-	85374.4

TOTAL VOLUME 529608.7

PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
TOTAL	99.	11.	0.	110.	122.

PRINTED REPORT NO. 3 - INDICATORS

MISSION

DESIGN MODE IND-ENDURANCE  
ENDUR DISP IND -AVG DISP  
ENDUR DEF IND -USN  
SUSTN SPEED IND-GIVEN  
ENDUR SPEED IND-GIVEN

HULL FORM FACTORS

HULL OFFSETS IND-GENERATE  
HULL DIM IND -B+T

HULL BOUNDARY CONDITIONS

HULL BC IND -CONV DD  
HULL STA IND -OPTIMUM

SHELL APPENDAGES

BILGE KEEL IND -PRESENT  
SKEG IND -PRESENT

MARGIN LINE

MARGIN LINE IND-CALC

HULL SUBDIVISION FACTORS

HULL SUBDIV IND-GIVEN

INNER BOTTOM

INNER BOTTOM IND-PRESENT

HULL LOADS

HULL LOADS IND -CALC  
SHOCK FNDTN IND-SHOCK

STRUCTURAL ARRANGEMENT

BOT PLATE LIMIT IND-CALC

STIFFENERS

STIFFENER SHAPE IND-CALC

DKHS GEOM FACTORS

DKHS GEOM IND -GENERATE  
DKHS SIZE IND -AUTO X

DKHS MATERIALS

DKHS MTRL TYPE IND-HTS  
FIRE PROTECT IND -NONE

DKHS LOADS

BLAST RESIST IND-7 PSI

ARRANGEMENT TYPES

MECH CL ARR IND -  
MECH PORT ARR IND -  
MECH STBD ARR IND -  
ELECT PG ARR 1 IND-M-PG  
ELECT PG ARR 2 IND-  
ELECT DL ARR IND -MTR

ARRANGEMENT CG

MACHY KG IND -GIVEN

ENGINE CONFIG FACTORS

ENG ENDUR RPM IND -CALC  
SEC ENG USAGE IND -  
ENDUR CONFIG IND -NO TS  
GT ENG ENCL IND -NONE  
DIESEL ENG MOUNT IND-NONE

MAIN ENGINES

GEARS

SEC ENG 2 SPD GEAR IND-  
GEAR IMPED MASS IND -PRESENT

PROPULSION SHAFTING

SHAFT SUPPORT TYPE IND-POD  
SHAFT SYS SIZE IND -CALC

PROPULSION SHAFT BEARING

THRUST BRG LOC IND-CALC

PROPELLER FACTORS

PROP TYPE IND -FP  
PROP SERIES IND-ANALYTIC  
PROP DIA IND -CALC  
PROP AREA IND -CALC  
PROP LOC IND -CALC  
PITCH RATIO IND-CALC

OPEN WATER PROP DATA

PROP ID IND -

PROPULSION SUPPORT SYS

INLET TYPE IND -PLENUM  
DUCT SILENCING IND -BOTH  
EXHAUST IR SUPP IND-NONE

SS GENERATOR FACTORS

SS SYS TYPE IND-PD  
FREQ CONV IND -

SS GENERATOR SIZE

SS GEN SIZE IND-NON STD

SS ENGINES

SS ENG SELECT IND -GIVEN  
SS ENG MODEL IND -MTU-12V538  
SS ENG TYPE IND -F DIESEL  
SS ENG SFC EQN IND-DIESEL  
SS ENG SIZE IND -CALC

SONAR SYSTEM

SONAR DOME IND -NONE  
SONAR DRAG IND -

CLIMATE CONTROL

COLL PROTECT SYS IND-PRESENT

REFER MACHY LOC IND -

AUX BOILER TYPE IND -ELECTRIC

SEA WATER SYSTEMS

AIR AND MISC FLUID SYSTEM

RUDDERS

RUDDER SIZE IND-CALC  
RUDDER TYPE IND-INTEGRAL

ROLL FINS

FIN SIZE IND -GIVEN

REPLENISHMENT SYSTEMS



MAIN ENG SELECT IND-GIVEN		SPECIAL PURPOSE SYSTEMS	
MAIN ENG MOD IND -OTHER		POLLUTION CNTL IND-PRESENT	
MAIN ENG TYPE IND -D DIESEL		OUTFIT AND FURNISHINGS	
MAIN ENG SFC EQ IND-DIESEL		UNIT CMDR IND -NONE	
MAIN ENG SIZE IND -GIVEN			
SEC ENGINES		FUELS AND LUBRICANTS	
SEC ENG SELECT IND -		SHIP FUEL TYPE IND-JP-5	
SEC ENG MODEL IND -		RESISTANCE FACTORS	
SEC ENG TYPE IND -		FRICTION LINE IND -ITT	
SEC ENG SFC EQN IND-		RESID RESIST IND -NRC	
SEC ENG SIZE IND -		WORM CURVE IND -DD CALC	
TRANSMISSION FACTORS		PRPLN SYS RESIST IND-CALC	
TRANS TYPE IND -ELECT		SHIP WEIGHT	
TRANS EFF IND -GIVEN		SHIP LCG INPUT IND-CALC	
ELECTRICAL TRANSMISSION			
ELECT PRPLN TYPE IND -ACR-DCS			
ELECT PRPLN RATIND IND-GIVEN			
AC SYNC ROTOR COOL IND-AIR			
TRANS LINE NODE PT IND-CALC			
SWITCHGEAR TYPE IND -ADV			
PRINTED REPORT NO. 4 - MARGINS			
HULL			
MIN FREEBOARD MARGIN, FT	.25		
HULL MARGIN STRESS, KSI	2.24		
PROPULSION PLANT			
TORQUE MARGIN FAC	1.200		
ELECTRIC PLANT			
ELECT LOAD DES MARGIN FAC	.200		
ELECT LOAD SL MARGIN FAC	.100		
AUXILIARY SYSTEMS			
AC MARGIN FAC	.200		
OUTFIT AND FURNISHINGS			
CREW ACCOM MARGIN FAC	.100		
WEIGHT MARGINS			
GROWTH WT MARGIN, LTON	.0		
D+B WT MARGIN, LTON	.0		
D+B WT MARGIN FAC	.125		
D+B KG MARGIN, FT	.00		
D+B KG MARGIN FAC	.125		
RESISTANCE FACTORS			
DRAG MARGIN FAC	.080		
SPACE FACTORS			
SPACE MARGIN FAC	.050		
PASSWAY MARGIN FAC	.000		
TANKAGE MARGIN FAC	.000		

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW	PAYLOAD AND ADJUSTMENT NAME
===	=====
1	CIC COMMAND AND DECISION MODFIG
2	EXCOMM (1/2 DDG51)
3	NAV SYS (1/2 DDG 51)
4	SPS-67 SSR
5	SPY-3C (MINI-SPY)
6	MK XII AIMS IFF
7	LUBE OIL SYS REDUCTION
8	SLQ-25 NIXIE
9	SLQ-32(V)3 ACTIVE/PASSIVE ECM
10	DESULFERIZER
11	CS HOLD UP BATTERY
12	SENSOR COOLING SYSTEMS
13	VSCF GEN AND CYCLO REDUCTION
14	CRANE
15	BALLAST
16	OPER READINESS AND TEST SYS
17	RAST/TALON HELO COMBO
18	RAST CONTROL STATION
19	LAMPS MKIV: AVIATION SUPPORT & SPARES
20	HANGAR
21	1X 40MM CIWS/MULTI PURP GUN
22	1X 40MM CIWS/MULTI PURP GUN
23	21 CELL RAM LAUNCHER
24	LONGITUDNAL BULKHEADS AROUND MAGAZINE
26	40MM AMMO (MIXED) 3000 RNDS
27	40MM AMMO (MIXED) -- 3000 RNDS
29	HELO AS565 PANTHER: (DOLPHIN)
30	LAMPS MKIII: FUEL [JP-5]
32	ADMIN LAN
34	AVIATION STORES
36	MINE DETECTION HULL MOUNTED SONAR

ROW	WT KEY	WT ADD LTON	WT FAC	VCG KEY	VCG ADD FT	VCG FAC
===	=====	=====	=====	=====	=====	=====
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
7	W262	-23.29	.000	BL	7.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
10	W261	4.70	.000	BL	10.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W311	-19.90	.000	BL	7.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000

15	W191	1.00	.000	BL	1.00	1.000
16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
20	W588	10.00	.000	BL	40.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000
22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000

ROW	AREA KEY	---AREA ADD, FT2---		-----AREA FAC-----	
		HULL/SS	SS/ONLY	HULL/SS	SS/ONLY
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
7	NONE	.00	.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
10	NONE	70.00	.00	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	NONE	.00	-224.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
20	A1312	.00	600.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

ROW	KW KEY	-----KW ADD, KW-----			-----KW FAC-----		
		W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
7	NONE	.00	.00	.00	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
10	NONE	50.00	100.00	50.00	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000
13	NONE	.00	.00	.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000
17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	5.00	10.00	5.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000



## APPENDIX D. 12.0 MEGAWATT PEMFC MODEL SUMMARY

This appendix contains the summary reports of each module for the 100% power PEMFC model. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.25.47.

PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	50.70
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-OPTIMUM	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	368.00	PRISMATIC COEF	0.570
LOA, FT	389.76	MAX SECTION COEF	0.795
BEAM, FT	50.55	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	55.16	LCB/LCP	0.515
DRAFT, FT	15.22	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.42	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.31	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.74	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	23.09	BARE HULL DISPL, LTON	3667.79
STABILITY BEAM, FT	50.55	AREA BEAM, FT	48.46

### BARE HULL DATA ON LWL

LGTH ON WL, FT	368.00
BEAM, FT	50.55
DRAFT, FT	15.22
FREEBOARD @ STA 3, FT	23.10
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	13659.67
WETTED SURFACE, FT2	18247.03
BARE HULL DISPL, LTON	3669.89
APPENDAGE DISPL, LTON	86.24
FULL LOAD WT, LTON	3756.12
HULL GEOM MODULE	1.750 CPU SECONDS.

### STABILITY DATA ON LWL

KB, FT	9.38
BMT, FT	16.40
KG, FT	21.14
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	4.05
GML, FT	787.59
GMT/B AVAIL	0.080
GMT/B REQ	0.080

ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.25.48.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	368.00	HULL AVG DECK HT, FT	11.41
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	441672.	NO TRANS BHDS	13
MR VOLUME, FT3	22948.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	26389.	NO MACHY RMS	3
EXCESS TANKAGE, FT3	5589.	NO PROP SHAFTS	2
ARR AREA LOST TANKS, FT2	26.3		
HULL ARR AREA AVAIL, FT2	34181.1		
HULL SUBDIV MODULE	0.625 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.25.49.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	368.00	DKHS LENGTH OA, FT	161.18
BEAM, FT	50.55	DKHS MAX WIDTH, FT	55.49
AREA BEAM, FT	48.46	DKHS HT (W/O PLTHS), FT	46.58
DKHS FWD LIMIT- STA	4.0	OTHER ARR AREA REQ, FT2	38041.76
DKHS AFT LIMIT- STA	12.8	HULL ARR AREA AVAIL, FT2	34181.14
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	5003.22
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	600.74
DKHS AVG SIDE ANG, DEG	10.00		
DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	10685.12
DKHS ARR AREA DERIV, FT2	193.64	DKHS ARR AREA AVAIL, FT2	8955.26
DKHS MIN ALW BEAM, FT	20.40	DKHS VOLUME, FT3	90793.70
BRIDGE L-O-S OVER BOW, FT	299.19		
		DKHS WEIGHT, LTON	174.51
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	40.67
DKHS SIDE ANG OFFSET, DEG			
DKHS DECK HT OFFSET, FT			
DECKHOUSE MODULE	1.000 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.25.50.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT

HULL LOADS IND-CALC

STIFFENER SHAPE IND-CALC

----- HULL STRENGTH AND STRESS -----

HOGGING BM, FT-LTON	60015.	PRIM STRESS KEEL-HOG, KSI	11.76
SAGGING BM, FT-LTON	50034.	PRIM STRESS KEEL-SAG, KSI	9.80
MIDSHIP MOI, FT2-IN2	191310.	PRIM STRESS DECK-HOG, KSI	12.14
DIST N.A. TO KEEL, FT	16.74	PRIM STRESS DECK-SAG, KSI	10.12
DIST N.A. TO DECK, FT	17.27	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN2	11431.	SEC MOD TO DECK, FT-IN2	11076.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	4	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		13

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	813.4	20.79
110	SHELL+SUPPORT	375.5	15.68
120	HULL STRUCTURAL BHD	105.5	19.96
130	HULL DECKS	251.9	30.75
140	HULL PLATFORM/FLATS	80.5	14.54
HULL STRUCT MODULE		1.500 CPU SECONDS.	

ASSET/MONOSC VERSION 3.3+ - APPENDAGE MODULE - 5/31/96 08.25.52.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 86.2

SHELL DISP, LTON 14.4

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	11.8	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8858	AVG RUDDER CHORD, FT	6.73
SKEG THK, FT	1.00	RUDDER THK, FT	1.00
SKEG PROJECTED AREA, FT2	414.4	RUDDER SPAN, FT	17.01
		RUDDER PROJECTED AREA, FT2	114.5
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	3.4
BILGE KEEL DISP, LTON	5.5		
BILGE KEEL LGTH, FT	86.94	FIN SIZE IND	GIVEN
		NO FIN PAIRS	1
SHAFT SUPPORT TYPE IND	POD	FWD FIN	
SHAFT SUPPORT DISP, LTON	44.8	CHORD, FT	11.16
SHAFT DISP, LTON	0.0	THK, FT	1.67
		SPAN, FT	7.76
PROP TYPE IND	FP	PROJECTED AREA, FT2	86.6



PROP BLADE DISP, LTON	0.8	DISP, LTON (PER PAIR)	5.5
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	11.66	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.250 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.25.53.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	3756.1	CORR ALW	0.00050
AVG ENDUR DISP, LTON	3550.2	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	478.9	TRAILSHAFT PWR FAC	0.00
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.186
NO PROP SHAFTS	2.	SUSTN SPEED	0.207
PROP DIA, FT	11.66	ENDUR SPEED	0.431

CONDITION	SPEED-----KT	FRIC	RESID	APPDGE	WIND	MARGIN	TOTAL	DRAG LBF
MAX	25.95	5517.	9070.	3641.	242.	1478.	19948.	250454.
SUSTN	25.00	4947.	6664.	3184.	217.	1201.	16213.	211330.
ENDUR	14.00	896.	402.	680.	39.	161.	2177.	50664.
RESISTANCE MODULE				1.000 CPU SECONDS.				

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.25.54.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL
MAX SPEED, KT	25.95	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	9974.	ENDUR EHP (/SHAFT), HP	1088.
MAX SHP (/SHAFT), HP	14381.	ENDUR SHP (/SHAFT), HP	1506.
MAX PROP RPM	220.0	ENDUR PROP RPM	108.8
MAX PROP EFF	0.694	ENDUR PROP EFF	0.723
SUSTN SPEED, KT	25.00	PROP DIA, FT	11.66
SUSTN EHP (/SHAFT), HP	8106.	NO BLADES	7.

SUSTN SHP (/SHAFT), HP	11536.	PITCH RATIO	1.26
SUSTN PROP RPM	206.9	EXPAND AREA RATIO	0.927
SUSTN PROP EFF	0.703	CAVITATION NO	1.68

NO PROP SHAFTS 2.0

TOTAL PROPELLER WT, LTON 14.38  
PROPELLER MODULE 0.875 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.25.56.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	25.95
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2722.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1145.	USABLE FUEL WT, LTON	479.0
SWBS 200 GROUP WT, LTON	331.2	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	138.2		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	1786. KW	1	0	0
VSCF SS CYCLO	2991. KW	2	2	1

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	OTHER		MTU-12V538
ENG TYPE IND	D DIESEL		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	2	0	1
ENG PWR AVAIL, HP	16171.		2492.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.333		.343
ENG LOAD FRAC	1.080		1.000
MACHINERY MODULE	2.000 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.25.58.

PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	368.0	TOTAL ACCOM	122.0
BEAM, FT	50.6	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	43136.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	532466.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	479.0	WATER HTR TYPE IND	INSTANT

FULL LOAD WT,LTON	3756.1	ANCHOR LOC IND	BOTTOM
MAX SHP, HP	32342.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 1786.1 KW  
 PD GEN: VSCF @ 5981.7 KW

TOTAL AIRCOND LOAD, TON	165.5	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT,LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT,LTON	0.3

BOAT SELECT IND	GIVEN		
BOAT TYPE IND	MIXED		
BOAT COMPLEMENT 2 RIB+UB/UB		NO FAS STATIONS	2.
SWBS 583 WT,LTON	35.6	RAS STATIONS: NO	TYPE
		2.	BULKHEAD

		SSCS 3.53 AREA,FT2	212.9
STRIKE GEAR: NO	TYPE	SWBS 571 WT,LTON	10.7
2.	PALLET		

STRK DECK AREA,FT2	429.6	STOWAGE AREA,FT2	1448.6
SWBS 572 WT,LTON	37.0	SWBS 671 WT,LTON	2.1
		SWBS 672 WT,LTON	13.1

AUXILIARY SYS MODULE 1.625 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.25.59.  
 PRINTED REPORT NO. 1 - SUMMARY

SWBS	GROUP	WT LTON	PER CENT	LCG FT	VCG FT	RESULTANT WT-LTON	ADJ VCG-FT
100	HULL STRUCTURE	1274.1	33.9	182.94	23.22	1.0	.00
200	PROP PLANT	331.2	8.8	266.89	9.63		
300	ELECT PLANT	138.2	3.7	329.87	23.62		
400	COMM + SURVEIL	132.8	3.5	139.84	27.68	82.9	.58
500	AUX SYSTEMS	544.4	14.5	202.40	23.37	20.0	.22
600	OUTFIT + FURN	312.0	8.3	184.00	22.73		
700	ARMAMENT	20.6	0.5	165.60	37.44	16.2	.17
M11	D+B WT MARGIN	344.0	9.2	202.17	21.91		
	D+B KG MARGIN			+	2.74		
	L I G H T S H I P	3097.2	82.5	202.17	24.64	120.1	.97
F00	FULL LOADS	658.9	17.5	130.06	4.65	85.0	.24
F10	CREW + EFFECTS	13.0		172.96	25.88		
F20	MISS REL EXPEN	21.2		161.92	12.16		
F30	SHIPS STORES	17.4		198.72	19.41		
F40	FUELS + LUBRIC	589.2		124.49	3.47		
F50	FRESH WATER	18.1			4.88		
F60	CARGO						
M24	FUTURE GROWTH						
	FULL LOAD WT	3756.1	100.0	189.52	21.14	205.1	1.21

WEIGHT MODULE

1.625 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.26.00.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	3756.1	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	11.41	AC MARGIN FAC	0.200
MR VOLUME, FT3	22948.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
DKHS ONLY	1591.0	5002.9	8955.3	90794.
HULL OR DKHS	2670.0	38042.2	34181.1	441672.
TOTAL	4261.0	43045.0	43136.4	532466.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
1.	MISSION SUPPORT	5609.4	2201.9	13.0
2.	HUMAN SUPPORT	7923.7	381.5	18.4
3.	SHIP SUPPORT	11764.2	1368.3	27.3
4.	SHIP MOBILITY SYSTEM	15697.9	812.9	36.5
5.	UNASSIGNED	2049.8	238.2	4.8
	TOTAL	43045.0	5002.9	100.0

SPACE MODULE

1.500 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - DESIGN SUMMARY - 5/31/96 08.26.02.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PROTON EXCHANGE MEMBRANE

12.0 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT		WEIGHT SUMMARY - LTON	
LBP	368.0	GROUP 1 - HULL STRUCTURE	1274.1
LOA	389.8	GROUP 2 - PROP PLANT	331.2
BEAM, DWL	50.6	GROUP 3 - ELECT PLANT	138.2
BEAM, WEATHER DECK	55.2	GROUP 4 - COMM + SURVEIL	132.8
DEPTH @ STA 10	34.0	GROUP 5 - AUX SYSTEMS	544.4
DRAFT TO KEEL DWL	15.2	GROUP 6 - OUTFIT + FURN	312.0
DRAFT TO KEEL LWL	15.2	GROUP 7 - ARMAMENT	20.6
FREEBOARD @ STA 3	23.1		
GMT	4.0	SUM GROUPS 1-7	2753.2
CP	0.570	DESIGN MARGIN	344.0
CX	0.795		

SPEED(KT): MAX= 26.0 SUST= 25.0  
ENDURANCE: 8000.0 NM AT 14.0 KTS

TRANSMISSION TYPE: ELECT  
MAIN ENG: 2 D DIESEL @ 16171.1 HP

SHAFT POWER/SHAFT: 14381.0 HP  
PROPELLERS: 2 - FP - 11.7 FT DIA

SEP GEN: 1 F DIESEL @ 1786.1 KW  
PD GEN: 2 VSCF @ 2990.9 KW

24 HR LOAD 1144.7  
MAX MARG ELECT LOAD 2721.5

	OFF	CPO	ENL	TOTAL
MANNING	15	13	82	110
ACCOM	17	15	90	122

LIGHTSHIP WEIGHT 3097.2  
LOADS 658.9

FULL LOAD DISPLACEMENT 3756.1  
FULL LOAD KG: FT 21.1

MILITARY PAYLOAD WT - LTON 201.5  
USABLE FUEL WT - LTON 479.0

AREA SUMMARY - FT2  
HULL AREA - 34181.1  
SUPERSTRUCTURE AREA - 8955.3

TOTAL AREA 43136.4

VOLUME SUMMARY - FT3  
HULL VOLUME - 441672.0  
SUPERSTRUCTURE VOLUME - 90793.7

TOTAL VOLUME 532465.7

# PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
TOTAL	99.	11.	0.	110.	122.

# PRINTED REPORT NO. 3 - INDICATORS

## MISSION

DESIGN MODE IND-ENDURANCE  
ENDUR DISP IND -AVG DISP  
ENDUR DEF IND -USN  
SUSTN SPEED IND-GIVEN  
ENDUR SPEED IND-GIVEN

## HULL FORM FACTORS

HULL OFFSETS IND-GENERATE  
HULL DIM IND -B+T  
HULL BOUNDARY CONDITIONS  
HULL BC IND -CONV DD  
HULL STA IND -OPTIMUM

## SHELL APPENDAGES

BILGE KEEL IND -PRESENT  
SKEG IND -PRESENT

## MARGIN LINE

MARGIN LINE IND-CALC  
HULL SUBDIVISION FACTORS

## GEARS

SEC ENG 2 SPD GEAR IND-  
GEAR IMPED MASS IND -PRESENT

## PROPULSION SHAFTING

SHAFT SUPPORT TYPE IND-POD  
SHAFT SYS SIZE IND -CALC

## PROPULSION SHAFT BEARING

THRUST BRG LOC IND-CALC

## PROPELLER FACTORS

PROP TYPE IND -FP  
PROP SERIES IND-ANALYTIC  
PROP DIA IND -CALC  
PROP AREA IND -CALC  
PROP LOC IND -CALC  
PITCH RATIO IND-CALC

## OPEN WATER PROP DATA

PROP ID IND -  
PROPULSION SUPPORT SYS

HULL SUBDIV IND-GIVEN  
 INNER BOTTOM  
 INNER BOTTOM IND-PRESENT  
 HULL LOADS  
 HULL LOADS IND -CALC  
 SHOCK FNDTN IND-SHOCK  
 STRUCTURAL ARRANGEMENT  
 BOT PLATE LIMIT IND-CALC  
 STIFFENERS  
 STIFFENER SHAPE IND-CALC  
 DKHS GEOM FACTORS  
 DKHS GEOM IND -GENERATE  
 DKHS SIZE IND -AUTO X  
 DKHS MATERIALS  
 DKHS MTRL TYPE IND-HTS  
 FIRE PROTECT IND -NONE  
 DKHS LOADS  
 BLAST RESIST IND-7 PSI  
 ARRANGEMENT TYPES  
 MECH CL ARR IND -  
 MECH PORT ARR IND -  
 MECH STBD ARR IND -  
 ELECT PG ARR 1 IND-M-PG  
 ELECT PG ARR 2 IND-  
 ELECT DL ARR IND -MTR  
 ARRANGEMENT CG  
 MACHY KG IND -GIVEN  
 ENGINE CONFIG FACTORS  
 ENG ENDUR RPM IND -CALC  
 SEC ENG USAGE IND -  
 ENDUR CONFIG IND -NO TS  
 GT ENG ENCL IND -NONE  
 DIESEL ENG MOUNT IND-NONE  
 MAIN ENGINES  
 MAIN ENG SELECT IND-GIVEN  
 MAIN ENG MOD IND -OTHER  
 MAIN ENG TYPE IND -D DIESEL  
 MAIN ENG SFC EQ IND-DIESEL  
 MAIN ENG SIZE IND -GIVEN  
 SEC ENGINES  
 SEC ENG SELECT IND -  
 SEC ENG MODEL IND -  
 SEC ENG TYPE IND -  
 SEC ENG SFC EQN IND-  
 SEC ENG SIZE IND -  
 TRANSMISSION FACTORS  
 TRANS TYPE IND -ELECT  
 TRANS EFF IND -GIVEN  
 ELECTRICAL TRANSMISSION  
 ELECT PRPLN TYPE IND -ACR-DCS  
 ELECT PRPLN RATIND IND-GIVEN  
 AC SYNC ROTOR COOL IND-AIR  
 TRANS LINE NODE PT IND-CALC  
 SWITCHGEAR TYPE IND -ADV

INLET TYPE IND -PLENUM  
 DUCT SILENCING IND -BOTH  
 EXHAUST IR SUPP IND-NONE  
 SS GENERATOR FACTORS  
 SS SYS TYPE IND-PD  
 FREQ CONV IND -  
 SS GENERATOR SIZE  
 SS GEN SIZE IND-NON STD  
 SS ENGINES  
 SS ENG SELECT IND -GIVEN  
 SS ENG MODEL IND -MTU-12V538  
 SS ENG TYPE IND -F DIESEL  
 SS ENG SFC EQN IND-DIESEL  
 SS ENG SIZE IND -CALC  
 SONAR SYSTEM  
 SONAR DOME IND -NONE  
 SONAR DRAG IND -  
 CLIMATE CONTROL  
  
 COLL PROTECT SYS IND-PRESENT  
 REFER MACHY LOC IND -  
 AUX BOILER TYPE IND -ELECTRIC  
 SEA WATER SYSTEMS  
  
 AIR AND MISC FLUID SYSTEM  
  
 RUDDERS  
 RUDDER SIZE IND-CALC  
 RUDDER TYPE IND-INTEGRAL  
 ROLL FINS  
 FIN SIZE IND -GIVEN  
 REPLENISHMENT SYSTEMS  
  
 SPECIAL PURPOSE SYSTEMS  
 POLLUTION CNTL IND-PRESENT  
 OUTFIT AND FURNISHINGS  
 UNIT CMDR IND -NONE  
  
 FUELS AND LUBRICANTS  
 SHIP FUEL TYPE IND-JP-5  
 RESISTANCE FACTORS  
 FRICTION LINE IND -ITTC  
 RESID RESIST IND -NRC  
 WORM CURVE IND -DD CALC  
 PRPLN SYS RESIST IND-CALC  
 SHIP WEIGHT  
 SHIP LCG INPUT IND-CALC

PRINTED REPORT NO. 4 - MARGINS

HULL

MIN FREEBOARD MARGIN, FT	.25
HULL MARGIN STRESS, KSI	2.24

PROPULSION PLANT

TORQUE MARGIN FAC	1.200
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ELECTRIC PLANT

ELECT LOAD DES MARGIN FAC	.200
ELECT LOAD SL MARGIN FAC	.100

AUXILIARY SYSTEMS

AC MARGIN FAC	.200
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OUTFIT AND FURNISHINGS

CREW ACCOM MARGIN FAC	.100
-----------------------	------

WEIGHT MARGINS

GROWTH WT MARGIN, LTON	.0
D+B WT MARGIN, LTON	.0
D+B WT MARGIN FAC	.125
D+B KG MARGIN, FT	.00
D+B KG MARGIN FAC	.125

RESISTANCE FACTORS

DRAG MARGIN FAC	.080
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SPACE FACTORS

SPACE MARGIN FAC	.050
PASSWAY MARGIN FAC	.000
TANKAGE MARGIN FAC	.000

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW PAYLOAD AND ADJUSTMENT NAME

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=====
1  CIC COMMAND AND DECISION MODFIG
2  EXCOMM (1/2 DDG51)
3  NAV SYS (1/2 DDG 51)
4  SPS-67 SSR
5  SPY-3C (MINI-SPY)
6  MK XII AIMS IFF
7  LUBE OIL SYS REDUCTION
8  SLQ-25 NIXIE
9  SLQ-32(V)3 ACTIVE/PASSIVE ECM
10 DESULFERIZER
11 CS HOLD UP BATTERY
12 SENSOR COOLING SYSTEMS
13 VSCF GENS AND CYCLO REDUCTION
14 CRANE
  
```

15 BALLAST  
 16 OPER READINESS AND TEST SYS  
 17 RAST/TALON HELO COMBO  
 18 RAST CONTROL STATION  
 19 LAMPS MKIV: AVIATION SUPPORT & SPARES  
 20 HELO HANGAR  
 21 1X 40MM CIWS/MULTI PURP GUN  
 22 1X 40MM CIWS/MULTI PURP GUN  
 23 21 CELL RAM LAUNCHER  
 24 LONGITUDNAL BULKHEADS AROUND MAGAZINE  
 26 40MM AMMO (MIXED) 3000 RNDS  
 27 40MM AMMO (MIXED) -- 3000 RNDS  
 29 HELO AS565 PANTHER: (DOLPHIN)  
 30 LAMPS MKIII: FUEL [JP-5]  
 32 ADMIN LAN  
 34 AVIATION STORES  
 36 MINE DETECTION HULL MOUNTED SONAR

ROW	WT KEY	WT ADD LTON	WT FAC	VCG KEY	VCG ADD FT	VCG FAC
===	=====	=====	=====	=====	=====	=====
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
7	W262	-24.56	.000	BL	7.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
10	W261	5.20	.000	BL	10.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W311	-20.20	.000	BL	7.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000
15	W191	1.00	.000	BL	1.00	1.000
16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
20	W588	10.00	.000	BL	40.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000
22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000



ROW	AREA KEY	---AREA ADD, FT2---		-----AREA FAC-----	
		HULL/SS	SS/ONLY	HULL/SS	SS/ONLY
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
7	NONE	.00	.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
10	NONE	70.00	.00	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	NONE	-244.00	.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
20	A1312	.00	600.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

ROW	KW KEY	-----KW ADD, KW-----			-----KW FAC-----		
		W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
7	NONE	.00	.00	.00	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
10	NONE	50.00	100.00	50.00	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000
13	NONE	.00	.00	.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000

17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	5.00	10.00	5.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000



## APPENDIX E. 13.2 MEGAWATT PEMFC MODEL SUMMARY

This appendix contains the summary reports of each module for the 110% power PEMFC model. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.26.30.

PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	50.70
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-OPTIMUM	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	369.00	PRISMATIC COEF	0.570
LOA, FT	390.65	MAX SECTION COEF	0.795
BEAM, FT	50.64	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	55.22	LCB/LCP	0.515
DRAFT, FT	15.37	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.43	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.32	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.74	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	22.95	BARE HULL DISPL, LTON	3719.97
STABILITY BEAM, FT	50.64	AREA BEAM, FT	48.92

### BARE HULL DATA ON LWL

LGTH ON WL, FT	369.00
BEAM, FT	50.64
DRAFT, FT	15.36
FREEBOARD @ STA 3, FT	22.96
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	13721.08
WETTED SURFACE, FT2	18379.85
BARE HULL DISPL, LTON	3722.10
APPENDAGE DISPL, LTON	86.63
FULL LOAD WT, LTON	3808.73
HULL GEOM MODULE	1.750 CPU SECONDS.

### STABILITY DATA ON LWL

KB, FT	9.47
BMT, FT	16.31
KG, FT	21.12
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	4.05
GML, FT	784.51
GMT/B AVAIL	0.080
GMT/B REQ	0.080

ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.26.32.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	369.00	HULL AVG DECK HT, FT	11.43
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	442427.	NO TRANS BHDS	13
MR VOLUME, FT3	23184.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	26651.	NO MACHY RMS	3
EXCESS TANKAGE, FT3	5185.	NO PROP SHAFTS	2
ARR AREA LOST TANKS, FT2	26.3		
HULL ARR AREA AVAIL, FT2	34190.7		
HULL SUBDIV MODULE	0.625 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.26.33.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	369.00	DKHS LENGTH OA, FT	167.67
BEAM, FT	50.64	DKHS MAX WIDTH, FT	55.54
AREA BEAM, FT	48.92	DKHS HT (W/O PLTHS), FT	46.56
DKHS FWD LIMIT- STA	4.0	OTHER ARR AREA REQ, FT2	38278.82
DKHS AFT LIMIT- STA	13.1	HULL ARR AREA AVAIL, FT2	34190.65
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	5127.38
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	602.22
DKHS AVG SIDE ANG, DEG	10.00		
DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	10724.04
DKHS ARR AREA DERIV, FT2	200.61	DKHS ARR AREA AVAIL, FT2	9306.94
DKHS MIN ALW BEAM, FT	20.42	DKHS VOLUME, FT3	94370.46
BRIDGE L-O-S OVER BOW, FT	298.88		
		DKHS WEIGHT, LTON	181.39
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	40.59
DKHS SIDE ANG OFFSET, DEG			
DKHS DECK HT OFFSET, FT			
DECKHOUSE MODULE	1.125 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.26.34.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT  
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

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----- HULL STRENGTH AND STRESS -----
HOGGING BM, FT-LTON      60531.    PRIM STRESS KEEL-HOG, KSI    12.10
SAGGING BM, FT-LTON      50464.    PRIM STRESS KEEL-SAG, KSI    10.09
MIDSHIP MOI, FT2-IN2     187669.   PRIM STRESS DECK-HOG, KSI    12.47
DIST N.A. TO KEEL, FT    16.74    PRIM STRESS DECK-SAG, KSI    10.40
DIST N.A. TO DECK, FT    17.26    HULL MARGIN STRESS, KSI      2.24
SEC MOD TO KEEL, FT-IN2  11208.   SEC MOD TO DECK, FT-IN2     10871.
HULL STRUCTURE COMPONENTS

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	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	4	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		13

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	816.8	20.76
110	SHELL+SUPPORT	378.3	15.63
120	HULL STRUCTURAL BHD	105.3	19.98
130	HULL DECKS	252.6	30.75
140	HULL PLATFORM/FLATS	80.5	14.54

HULL STRUCT MODULE 1.500 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - APPENDAGE MODULE - 5/31/96 08.26.35.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 86.6

SHELL DISP, LTON 14.4

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	12.0	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8859	AVG RUDDER CHORD, FT	6.80
SKEG THK, FT	1.00	RUDDER THK, FT	1.02
SKEG PROJECTED AREA, FT2	420.0	RUDDER SPAN, FT	17.05
		RUDDER PROJECTED AREA, FT2	115.9
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	3.5
BILGE KEEL DISP, LTON	5.5		
BILGE KEEL LGTH, FT	87.18	FIN SIZE IND	GIVEN
		NO FIN PAIRS	1

SHAFT SUPPORT TYPE IND	POD	FWD FIN	
SHAFT SUPPORT DISP, LTON	44.8	CHORD, FT	11.16
SHAFT DISP, LTON	0.0	THK, FT	1.67
		SPAN, FT	7.76
PROP TYPE IND	FP	PROJECTED AREA, FT2	86.6
PROP BLADE DISP, LTON	0.8	DISP, LTON (PER PAIR)	5.5
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	11.67	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.375 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.26.37.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	3808.7	CORR ALW	0.00050
AVG ENDUR DISP, LTON	3600.4	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	484.5	TRAILSHAFT PWR FAC	0.00
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.185
NO PROP SHAFTS	2.	SUSTN SPEED	0.205
PROP DIA, FT	11.67	ENDUR SPEED	0.427

CONDITION	SPEED-----KT	FRIC	RESID	APPDGD	WIND	MARGIN	TOTAL	DRAG LBF
MAX	25.96	5560.	9149.	3648.	240.	1488.	20086.	252110.
SUSTN	25.00	4982.	6729.	3188.	215.	1209.	16323.	212770.
ENDUR	14.00	902.	407.	680.	38.	162.	2189.	50950.
RESISTANCE MODULE				1.125 CPU SECONDS.				

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.26.38.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL
MAX SPEED, KT	25.96	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	10043.	ENDUR EHP (/SHAFT), HP	1094.
MAX SHP (/SHAFT), HP	14491.	ENDUR SHP (/SHAFT), HP	1516.

MAX PROP RPM	220.0	ENDUR PROP RPM	108.7
MAX PROP EFF	0.693	ENDUR PROP EFF	0.722
SUSTN SPEED, KT	25.00	PROP DIA, FT	11.67
SUSTN EHP (/SHAFT), HP	8162.	NO BLADES	7.
SUSTN SHP (/SHAFT), HP	11625.	PITCH RATIO	1.26
SUSTN PROP RPM	206.9	EXPAND AREA RATIO	0.930
SUSTN PROP EFF	0.702	CAVITATION NO	1.68
NO PROP SHAFTS	2.0		
TOTAL PROPELLER WT, LTON	14.49		
PROPELLER MODULE	1.000 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.26.39.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	25.96
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2732.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1150.	USABLE FUEL WT, LTON	484.5
SWBS 200 GROUP WT, LTON	348.5	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	138.6		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	1793. KW	1	0	0
VSCF SS CYCLO	3006. KW	2	2	1

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	OTHER		MTU-12V538
ENG TYPE IND	D DIESEL		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	2	0	1
ENG PWR AVAIL, HP	17787.		2502.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.333		.343
ENG LOAD FRAC	0.989		1.000
MACHINERY MODULE	2.125 CPU SECONDS.		



ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.26.41.

PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	369.0	TOTAL ACCOM	122.0
BEAM, FT	50.6	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	43498.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	536797.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	484.5	WATER HTR TYPE IND	INSTANT
FULL LOAD WT, LTON	3808.7	ANCHOR LOC IND	BOTTOM
MAX SHP, HP	35574.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 1793.3 KW

PD GEN: VSCF @ 6012.7 KW

TOTAL AIRCOND LOAD, TON	165.7	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT, LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT, LTON	0.3
BOAT SELECT IND	GIVEN		
BOAT TYPE IND	MIXED		
BOAT COMPLEMENT 2 RIB+UB/UB		NO FAS STATIONS	2.
SWBS 583 WT, LTON	35.6	RAS STATIONS: NO	TYPE
		2.	

BULKHEAD

STRIKE GEAR: NO	TYPE	SSCS 3.53 AREA, FT2	212.9
2.	PALLET	SWBS 571 WT, LTON	10.7
STRK DECK AREA, FT2	429.7	STOWAGE AREA, FT2	1449.8
SWBS 572 WT, LTON	37.1	SWBS 671 WT, LTON	2.1
		SWBS 672 WT, LTON	13.1

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.26.43.

PRINTED REPORT NO. 1 - SUMMARY

SWBS	GROUP	WEIGHT		LCG	VCG	RESULTANT ADJ	
		LTON	PER CENT	FT	FT	WT-LTON	VCG-FT
100	HULL STRUCTURE	1289.5	33.9	183.73	23.24	1.0	.00
200	PROP PLANT	348.5	9.1	265.99	9.81		
300	ELECT PLANT	138.6	3.6	331.43	23.63		
400	COMM + SURVEIL	133.1	3.5	140.22	27.70	82.9	.57
500	AUX SYSTEMS	548.5	14.4	202.95	23.43	20.0	.21
600	OUTFIT + FURN	314.3	8.3	184.50	22.80		
700	ARMAMENT	20.6	0.5	166.05	37.44	16.2	.17
M11	D+B WT MARGIN	349.0	9.2	202.98	21.89		
	D+B KG MARGIN			+	2.74		
=====							
L I G H T S H I P		3142.1	82.5	202.98	24.62	120.1	.96
=====							

F00	FULL LOADS	666.7	17.5	129.02	4.62	85.0	.23
F10	CREW + EFFECTS	13.0		173.43	25.88		
F20	MISS REL EXPEN	21.2		162.36	12.16		
F30	SHIPS STORES	17.4		199.26	19.41		
F40	FUELS + LUBRIC	596.9		123.35	3.46		
F50	FRESH WATER	18.1			4.88		
F60	CARGO						
M24	FUTURE GROWTH						

FULL LOAD WT	3808.7	100.0	190.04	21.12	205.1	1.19
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WEIGHT MODULE 1.625 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.26.44.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	3808.7	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	11.43	AC MARGIN FAC	0.200
MR VOLUME, FT3	23184.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
DKHS ONLY	1591.0	5127.3	9306.9	94370.
HULL OR DKHS	2670.0	38278.9	34190.7	442427.
TOTAL	4261.0	43406.3	43497.6	536797.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
1.	MISSION SUPPORT	5614.4	2203.4	12.9
2.	HUMAN SUPPORT	7923.7	381.5	18.3
3.	SHIP SUPPORT	11823.2	1410.6	27.2
4.	SHIP MOBILITY SYSTEM	15977.9	887.7	36.8
5.	UNASSIGNED	2067.0	244.2	4.8

TOTAL	43406.3	5127.3	100.0
SPACE MODULE	1.375 CPU SECONDS.		

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PROTON EXCHANGE MEMBRANE

13.2 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT		WEIGHT SUMMARY - LTON	
LBP	369.0	GROUP 1 - HULL STRUCTURE	1289.5
LOA	390.7	GROUP 2 - PROP PLANT	348.5
BEAM, DWL	50.6	GROUP 3 - ELECT PLANT	138.6
BEAM, WEATHER DECK	55.2	GROUP 4 - COMM + SURVEIL	133.1
DEPTH @ STA 10	34.0	GROUP 5 - AUX SYSTEMS	548.5
DRAFT TO KEEL DWL	15.4	GROUP 6 - OUTFIT + FURN	314.3
DRAFT TO KEEL LWL	15.4	GROUP 7 - ARMAMENT	20.6
FREEBOARD @ STA 3	23.0	-----	
GMT	4.1	SUM GROUPS 1-7	2793.1
CP	0.570	DESIGN MARGIN	349.0
CX	0.795	-----	
SPEED(KT): MAX= 26.0 SUST= 25.0		LIGHTSHIP WEIGHT	3142.1
ENDURANCE: 8000.0 NM AT 14.0 KTS		LOADS	666.7
TRANSMISSION TYPE: ELECT		-----	
MAIN ENG: 2 D DIESEL @ 17787.0 HP		FULL LOAD DISPLACEMENT	3808.7
SHAFT POWER/SHAFT: 14491.2 HP		FULL LOAD KG: FT	21.1
PROPELLERS: 2 - FP - 11.7 FT DIA		-----	
SEP GEN: 1 F DIESEL @ 1793.3 KW		MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 3006.3 KW		USABLE FUEL WT - LTON	484.5
24 HR LOAD		-----	
MAX MARG ELECT LOAD		AREA SUMMARY - FT2	
		HULL AREA	34190.7
		SUPERSTRUCTURE AREA	9306.9
		-----	
		TOTAL AREA	43497.6
		-----	
		VOLUME SUMMARY - FT3	
		HULL VOLUME	442426.9
		SUPERSTRUCTURE VOLUME	94370.5
		-----	
		TOTAL VOLUME	536797.4

PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
TOTAL	99.	11.	0.	110.	122.

PRINTED REPORT NO. 3 - INDICATORS

MISSION

DESIGN MODE IND-ENDURANCE  
ENDUR DISP IND -AVG DISP  
ENDUR DEF IND -USN  
SUSTN SPEED IND-GIVEN  
ENDUR SPEED IND-GIVEN

HULL FORM FACTORS

HULL OFFSETS IND-GENERATE  
HULL DIM IND -B+T

HULL BOUNDARY CONDITIONS

HULL BC IND -CONV DD  
HULL STA IND -OPTIMUM

SHELL APPENDAGES

BILGE KEEL IND -PRESENT  
SKEG IND -PRESENT

MARGIN LINE

MARGIN LINE IND-CALC

HULL SUBDIVISION FACTORS

HULL SUBDIV IND-GIVEN

INNER BOTTOM

INNER BOTTOM IND-PRESENT

HULL LOADS

HULL LOADS IND -CALC  
SHOCK FNDTN IND-SHOCK

STRUCTURAL ARRANGEMENT

BOT PLATE LIMIT IND-CALC

STIFFENERS

STIFFENER SHAPE IND-CALC

DKHS GEOM FACTORS

DKHS GEOM IND -GENERATE  
DKHS SIZE IND -AUTO X

DKHS MATERIALS

DKHS MTRL TYPE IND-HTS  
FIRE PROTECT IND -NONE

DKHS LOADS

BLAST RESIST IND-7 PSI

ARRANGEMENT TYPES

MECH CL ARR IND -  
MECH PORT ARR IND -  
MECH STBD ARR IND -  
ELECT PG ARR 1 IND-M-PG  
ELECT PG ARR 2 IND-  
ELECT DL ARR IND -MTR

ARRANGEMENT CG

MACHY KG IND -GIVEN

ENGINE CONFIG FACTORS

ENG ENDUR RPM IND -CALC  
SEC ENG USAGE IND -  
ENDUR CONFIG IND -NO TS  
GT ENG ENCL IND -NONE  
DIESEL ENG MOUNT IND-NONE

MAIN ENGINES

GEARS

SEC ENG 2 SPD GEAR IND-  
GEAR IMPED MASS IND -PRESENT

PROPULSION SHAFTING

SHAFT SUPPORT TYPE IND-POD  
SHAFT SYS SIZE IND -CALC

PROPULSION SHAFT BEARING

THRUST BRG LOC IND-CALC

PROPELLER FACTORS

PROP TYPE IND -FP  
PROP SERIES IND-ANALYTIC  
PROP DIA IND -CALC  
PROP AREA IND -CALC  
PROP LOC IND -CALC  
PITCH RATIO IND-CALC

OPEN WATER PROP DATA

PROP ID IND -

PROPULSION SUPPORT SYS

INLET TYPE IND -PLENUM  
DUCT SILENCING IND -BOTH  
EXHAUST IR SUPP IND-NONE

SS GENERATOR FACTORS

SS SYS TYPE IND-PD  
FREQ CONV IND -

SS GENERATOR SIZE

SS GEN SIZE IND-NON STD

SS ENGINES

SS ENG SELECT IND -GIVEN  
SS ENG MODEL IND -MTU-12V538  
SS ENG TYPE IND -F DIESEL  
SS ENG SFC EQN IND-DIESEL  
SS ENG SIZE IND -CALC

SONAR SYSTEM

SONAR DOME IND -NONE  
SONAR DRAG IND -

CLIMATE CONTROL

COLL PROTECT SYS IND-PRESENT

REFER MACHY LOC IND -

AUX BOILER TYPE IND -ELECTRIC

SEA WATER SYSTEMS

AIR AND MISC FLUID SYSTEM

RUDDERS

RUDDER SIZE IND-CALC  
RUDDER TYPE IND-INTEGRAL

ROLL FINS

FIN SIZE IND -GIVEN

REPLENISHMENT SYSTEMS

MAIN ENG SELECT IND-GIVEN  
 MAIN ENG MOD IND -OTHER  
 MAIN ENG TYPE IND -D DIESEL  
 MAIN ENG SFC EQ IND-DIESEL  
 MAIN ENG SIZE IND -GIVEN  
 SEC ENGINES  
 SEC ENG SELECT IND -  
 SEC ENG MODEL IND -  
 SEC ENG TYPE IND -  
 SEC ENG SFC EQN IND-  
 SEC ENG SIZE IND -  
 TRANSMISSION FACTORS  
 TRANS TYPE IND -ELECT  
 TRANS EFF IND -GIVEN  
 ELECTRICAL TRANSMISSION  
 ELECT PRPLN TYPE IND -ACR-DCS  
 ELECT PRPLN RATIND IND-GIVEN  
 AC SYNC ROTOR COOL IND-AIR  
 TRANS LINE NODE PT IND-CALC  
 SWITCHGEAR TYPE IND -ADV

SPECIAL PURPOSE SYSTEMS  
 POLLUTION CNTL IND-PRESENT  
 OUTFIT AND FURNISHINGS  
 UNIT CMDR IND -NONE

FUELS AND LUBRICANTS  
 SHIP FUEL TYPE IND-JP-5  
 RESISTANCE FACTORS  
 FRICTION LINE IND -ITT  
 RESID RESIST IND -NRC  
 WORM CURVE IND -DD CALC  
 PRPLN SYS RESIST IND-CALC  
 SHIP WEIGHT  
 SHIP LCG INPUT IND-CALC

# PRINTED REPORT NO. 4 - MARGINS

## HULL

MIN FREEBOARD MARGIN, FT	.25
HULL MARGIN STRESS, KSI	2.24

## PROPULSION PLANT

TORQUE MARGIN FAC	1.200
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## ELECTRIC PLANT

ELECT LOAD DES MARGIN FAC	.200
ELECT LOAD SL MARGIN FAC	.100

## AUXILIARY SYSTEMS

AC MARGIN FAC	.200
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## OUTFIT AND FURNISHINGS

CREW ACCOM MARGIN FAC	.100
-----------------------	------

## WEIGHT MARGINS

GROWTH WT MARGIN, LTON	.0
D+B WT MARGIN, LTON	.0
D+B WT MARGIN FAC	.125
D+B KG MARGIN, FT	.00
D+B KG MARGIN FAC	.125

## RESISTANCE FACTORS

DRAG MARGIN FAC	.080
-----------------	------

## SPACE FACTORS

SPACE MARGIN FAC	.050
PASSWAY MARGIN FAC	.000
TANKAGE MARGIN FAC	.000

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW	PAYLOAD AND ADJUSTMENT NAME
1	CIC COMMAND AND DECISION MODFIG
2	EXCOMM (1/2 DDG51)
3	NAV SYS (1/2 DDG 51)
4	SPS-67 SSR
5	SPY-3C (MINI-SPY)
6	MK XII AIMS IFF
7	LUBE OIL SYS REDUCTION
8	SLQ-25 NIXIE
9	SLQ-32(V)3 ACTIVE/PASSIVE ECM
10	DESULFERIZER
11	CS HOLD UP BATTERY
12	SENSOR COOLING SYSTEMS
13	VSCF GENS AND CYCLO REDUCTION
14	CRANE
15	BALLAST
16	OPER READINESS AND TEST SYS
17	RAST/TALON HELO COMBO
18	RAST CONTROL STATION
19	LAMPS MKIV: AVIATION SUPPORT & SPARES
20	HELO HANGAR
21	1X 40MM CIWS/MULTI PURP GUN
22	1X 40MM CIWS/MULTI PURP GUN
23	21 CELL RAM LAUNCHER
24	LONGITUDNAL BULKHEADS AROUND MAGAZINE
26	40MM AMMO (MIXED) 3000 RNDs
27	40MM AMMO (MIXED) -- 3000 RNDs
29	HELO AS565 PANTHER: (DOLPHIN)
30	LAMPS MKIII: FUEL [JP-5]
32	ADMIN LAN
34	AVIATION STORES
36	MINE DETECTION HULL MOUNTED SONAR

ROW	WT KEY	WT ADD LTON	WT FAC	VCG KEY	VCG ADD FT	VCG FAC
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
7	W262	-25.70	.000	BL	7.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
10	W261	5.70	.000	BL	10.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W311	-20.30	.000	BL	7.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000

15	W191	1.00	.000	BL	1.00	1.000
16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
20	W588	10.00	.000	BL	40.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000
22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000

ROW	AREA KEY	---AREA ADD, FT2--- HULL/SS	SS/ONLY	-----AREA FAC----- HULL/SS	SS/ONLY
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
7	NONE	.00	.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
10	NONE	70.00	.00	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	NONE	-244.00	.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
20	A1312	.00	600.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

ROW	KW	-----KW ADD, KW-----			-----KW FAC-----		
	KEY	W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
7	NONE	.00	.00	.00	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
10	NONE	50.00	100.00	50.00	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000
13	NONE	.00	.00	.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000
17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	5.00	10.00	5.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000





## APPENDIX F. 10.8 MEGAWATT MCFC MODEL SUMMARY

This appendix contains the summary reports of each module for the 90% power MCFC model. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.29.22.

PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	55.00
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-GIVEN	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	385.00	PRISMATIC COEF	0.570
LOA, FT	403.53	MAX SECTION COEF	0.795
BEAM, FT	51.25	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	55.47	LCB/LCP	0.515
DRAFT, FT	16.81	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.68	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.47	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.77	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	21.65	BARE HULL DISPL, LTON	4296.91
STABILITY BEAM, FT	51.25	AREA BEAM, FT	50.62

### BARE HULL DATA ON LWL

LGTH ON WL, FT	385.00
BEAM, FT	51.25
DRAFT, FT	16.81
FREEBOARD @ STA 3, FT	21.66
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	14486.89
WETTED SURFACE, FT2	19966.61
BARE HULL DISPL, LTON	4299.36
APPENDAGE DISPL, LTON	106.53
FULL LOAD WT, LTON	4405.89
HULL GEOM MODULE	

### STABILITY DATA ON LWL

KB, FT	10.33
BMT, FT	15.25
KG, FT	19.85
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	5.13
GML, FT	780.66
GMT/B AVAIL	0.100
GMT/B REQ	0.100

1.750 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.29.24.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	385.00	HULL AVG DECK HT, FT	11.59
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	454673.	NO TRANS BHDS	12
MR VOLUME, FT3	36906.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	29633.	NO MACHY RMS	3
EXCESS TANKAGE, FT3	4896.	NO PROP SHAFTS	2
ARR AREA LOST TANKS, FT2	25.6		
HULL ARR AREA AVAIL, FT2	33592.5		
HULL SUBDIV MODULE	0.750 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.29.25.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	385.00	DKHS LENGTH OA, FT	194.28
BEAM, FT	51.25	DKHS MAX WIDTH, FT	55.85
AREA BEAM, FT	50.62	DKHS HT (W/O PLTHS), FT	46.56
DKHS FWD LIMIT-STA	4.0	OTHER ARR AREA REQ, FT2	38900.77
DKHS AFT LIMIT-STA	14.1	HULL ARR AREA AVAIL, FT2	33592.50
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	5361.43
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	612.01
DKHS AVG SIDE ANG, DEG	10.00		
DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	11222.54
DKHS ARR AREA DERIV, FT2	228.16	DKHS ARR AREA AVAIL, FT2	10761.41
DKHS MIN ALW BEAM, FT	20.55	DKHS VOLUME, FT3	109173.74
BRIDGE L-O-S OVER BOW, FT	284.15		
		DKHS WEIGHT, LTON	209.84
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	40.37
DKHS SIDE ANG OFFSET, DEG			
DKHS DECK HT OFFSET, FT			
DECKHOUSE MODULE	1.000 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.29.26.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT  
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

----- HULL STRENGTH AND STRESS -----			
HOGGING BM, FT-LTON	68117.	PRIM STRESS KEEL-HOG, KSI	13.43
SAGGING BM, FT-LTON	56789.	PRIM STRESS KEEL-SAG, KSI	11.19
MIDSHIP MOI, FT2-IN2	189861.	PRIM STRESS DECK-HOG, KSI	13.90
DIST N.A. TO KEEL, FT	16.71	PRIM STRESS DECK-SAG, KSI	11.59
DIST N.A. TO DECK, FT	17.30	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN2	11364.	SEC MOD TO DECK, FT-IN2	10974.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	4	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		12

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	840.6	20.76
110	SHELL+SUPPORT	400.2	15.52
120	HULL STRUCTURAL BHD	92.8	20.40
130	HULL DECKS	266.4	30.77
140	HULL PLATFORM/FLATS	81.1	14.13

HULL STRUCT MODULE 1.625 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+- APPENDAGE MODULE - 5/31/96 08.29.27.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 106.5

SHELL DISP, LTON 15.2

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	13.1	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8807	AVG RUDDER CHORD, FT	6.30
SKEG THK, FT	1.00	RUDDER THK, FT	0.85
SKEG PROJECTED AREA, FT2	459.8	RUDDER SPAN, FT	21.02
		RUDDER PROJECTED AREA, FT2	132.3
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	3.7
BILGE KEEL DISP, LTON	5.9		

BILGE KEEL LGTH, FT	90.96	FIN SIZE IND	CALC
		NO FIN PAIRS	1
SHAFT SUPPORT TYPE IND	POD	FWD FIN	
SHAFT SUPPORT DISP, LTON	61.3	CHORD, FT	10.25
SHAFT DISP, LTON	0.0	THK, FT	1.54
		SPAN, FT	10.25
PROP TYPE IND	FP	PROJECTED AREA, FT2	105.0
PROP BLADE DISP, LTON	1.1	DISP, LTON (PER PAIR)	6.2
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	13.82	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.250 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.29.29.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	4405.9	CORR ALW	0.00050
AVG ENDUR DISP, LTON	4158.9	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	570.8	TRAILSHAFT PWR FAC	1.15
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.208
NO PROP SHAFTS	2.	SUSTN SPEED	0.232
PROP DIA, FT	13.82	ENDUR SPEED	0.476

CONDITION	SPEED-----KT	FRIC	RESID	APPDG	WIND	MARGIN	TOTAL	DRAG LBF
MAX	26.04	6070.	9251.	4197.	242.	1581.	21340.	267043.
SUSTN	25.00	5391.	6740.	3669.	214.	1281.	17295.	225436.
ENDUR	14.00	974.	452.	813.	38.	182.	2460.	57249.
RESISTANCE MODULE				1.125 CPU SECONDS.				

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.29.30.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	ANY
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL

MAX SPEED, KT	26.04	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	10670.	ENDUR EHP (/SHAFT), HP	1230.
MAX SHP (/SHAFT), HP	14519.	ENDUR SHP (/SHAFT), HP	1619.
MAX PROP RPM	170.0	ENDUR PROP RPM	85.6
MAX PROP EFF	0.735	ENDUR PROP EFF	0.760

SUSTN SPEED, KT	25.00	PROP DIA, FT	13.82
SUSTN EHP (/SHAFT), HP	8648.	NO BLADES	5.
SUSTN SHP (/SHAFT), HP	11634.	PITCH RATIO	1.36
SUSTN PROP RPM	160.0	EXPAND AREA RATIO	0.722
SUSTN PROP EFF	0.743	CAVITATION NO	1.75

NO PROP SHAFTS 2.0

TOTAL PROPELLER WT, LTON 20.59  
PROPELLER MODULE 0.875 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.29.32.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	26.04
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2792.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1184.	USABLE FUEL WT, LTON	570.8
SWBS 200 GROUP WT, LTON	575.5	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	141.4		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	1833. KW	1	0	0
VSCF SS CYCLO	3093. KW	2	2	1

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	OTHER		MTU-12V538
ENG TYPE IND	D DIESEL		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	2	0	1
ENG PWR AVAIL, HP	14262.		2557.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.370		.342
ENG LOAD FRAC	1.267		1.000
MACHINERY MODULE	2.250 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.29.33.

PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	385.0	TOTAL ACCOM	122.0
BEAM, FT	51.2	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	44354.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	563847.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	570.8	WATER HTR TYPE IND	INSTANT
FULL LOAD WT, LTON	4405.9	ANCHOR LOC IND	BOTTOM
MAX SHP, HP	28523.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 1832.7 KW

PD GEN: VSCF @ 6185.0 KW

TOTAL AIRCOND LOAD, TON	166.5	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT, LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT, LTON	0.3
BOAT SELECT IND	GIVEN		
BOAT TYPE IND	MIXED		
BOAT COMPLEMENT 2 RIB+UB/UB		NO FAS STATIONS	2.
SWBS 583 WT, LTON	35.6	RAS STATIONS: NO	TYPE
		2.	

BULKHEAD

STRIKE GEAR: NO	TYPE	SSCS 3.53 AREA, FT2	214.7
2.	PALLET	SWBS 571 WT, LTON	10.7
STRK DECK AREA, FT2	430.2	STOWAGE AREA, FT2	1460.0
SWBS 572 WT, LTON	37.4	SWBS 671 WT, LTON	2.1
		SWBS 672 WT, LTON	13.3

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.29.35.

PRINTED REPORT NO. 1 - SUMMARY

SWBS	G R O U P	W E I G H T		LCG	VCG	RESULTANT ADJ	
=====	=====	LTON	PER CENT	FT	FT	WT-LTON	VCG-FT
=====	=====	=====	=====	=====	=====	=====	=====
100	HULL STRUCTURE	1457.5	33.1	192.72	22.18	1.0	.00
200	PROP PLANT	575.5	13.1	240.73	8.87		
300	ELECT PLANT	141.4	3.2	341.55	24.39		
400	COMM + SURVEIL	135.1	3.1	146.30	27.75	82.6	.49
500	AUX SYSTEMS	585.7	13.3	211.75	23.00	20.0	.18
600	OUTFIT + FURN	332.0	7.5	192.50	22.88		
700	ARMAMENT	20.7	0.5	173.25	37.44	16.2	.15
M11	D+B WT MARGIN	405.9	9.2	209.06	20.47		
	D+B KG MARGIN			+	2.56		

L I G H T S H I P	3653.7	82.9	209.06	23.03	119.8	.82
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F00	FULL LOADS	752.2	17.1	145.91	4.43	85.0	.20
F10	CREW + EFFECTS	13.0		180.95	25.91		
F20	MISS REL EXPEN	21.2		169.40	12.18		
F30	SHIPS STORES	17.4		207.90	19.44		
F40	FUELS + LUBRIC	682.4		141.88	3.39		
F50	FRESH WATER	18.1			4.89		
F60	CARGO						
M24	FUTURE GROWTH						

FULL LOAD WT	4405.9	100.0	198.28	19.85	204.8	1.03
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WEIGHT MODULE 1.500 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.29.36.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	4405.9	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	11.59	AC MARGIN FAC	0.200
MR VOLUME, FT3	36906.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
DKHS ONLY	1591.0	5361.6	10761.4	109174.
HULL OR DKHS	2670.0	38900.6	33592.5	454673.
TOTAL	4261.0	44262.2	44353.9	563847.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
1.	MISSION SUPPORT	5646.0	2213.7	12.8
2.	HUMAN SUPPORT	7923.7	381.5	17.9
3.	SHIP SUPPORT	12221.5	1578.4	27.6
4.	SHIP MOBILITY SYSTEM	16363.2	932.7	37.0
5.	UNASSIGNED	2107.7	255.3	4.8

TOTAL	44262.2	5361.6	100.0
SPACE MODULE	1.375 CPU SECONDS.		



PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

MOLTEN CARBONATE  
10.8 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP			385.0	GROUP 1 - HULL STRUCTURE	1457.5
LOA			403.5	GROUP 2 - PROP PLANT	575.5
BEAM, DWL			51.2	GROUP 3 - ELECT PLANT	141.4
BEAM, WEATHER DECK			55.5	GROUP 4 - COMM + SURVEIL	135.1
DEPTH @ STA 10			34.0	GROUP 5 - AUX SYSTEMS	585.7
DRAFT TO KEEL DWL			16.8	GROUP 6 - OUTFIT + FURN	332.0
DRAFT TO KEEL LWL			16.8	GROUP 7 - ARMAMENT	20.7
FREEBOARD @ STA 3			21.7	-----	
GMT			5.1	SUM GROUPS 1-7	3247.9
CP			0.570	DESIGN MARGIN	405.9
CX			0.795	-----	
SPEED(KT): MAX= 26.0 SUST= 25.0				LIGHTSHIP WEIGHT	3653.7
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	752.2
TRANSMISSION TYPE: ELECT				-----	
MAIN ENG: 2 D DIESEL @ 14261.5 HP				FULL LOAD DISPLACEMENT	4405.9
SHAFT POWER/SHAFT: 14519.0 HP				FULL LOAD KG: FT	19.9
PROPELLERS: 2 - FP - 13.8 FT DIA				-----	
SEP GEN: 1 F DIESEL @ 1832.7 KW				MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 3092.5 KW				USABLE FUEL WT - LTON	570.8
24 HR LOAD			1184.2	-----	
MAX MARG ELECT LOAD			2792.0	AREA SUMMARY - FT2	
				HULL AREA	- 33592.5
				SUPERSTRUCTURE AREA	- 10761.4
				-----	
				TOTAL AREA	44353.9
				-----	
				VOLUME SUMMARY - FT3	
				HULL VOLUME	- 454673.1
				SUPERSTRUCTURE VOLUME	- 109173.7
				-----	
				TOTAL VOLUME	563846.8

PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
-----					
TOTAL	99.	11.	0.	110.	122.

PRINTED REPORT NO. 3 - INDICATORS

MISSION

DESIGN MODE IND-ENDURANCE  
ENDUR DISP IND -AVG DISP  
ENDUR DEF IND -USN  
SUSTN SPEED IND-GIVEN  
ENDUR SPEED IND-GIVEN

HULL FORM FACTORS

HULL OFFSETS IND-GENERATE  
HULL DIM IND -B+T

HULL BOUNDARY CONDITIONS

HULL BC IND -CONV DD  
HULL STA IND -GIVEN

SHELL APPENDAGES

BILGE KEEL IND -PRESENT  
SKEG IND -PRESENT

MARGIN LINE

MARGIN LINE IND-CALC

HULL SUBDIVISION FACTORS

HULL SUBDIV IND-GIVEN

INNER BOTTOM

INNER BOTTOM IND-PRESENT

HULL LOADS

HULL LOADS IND -CALC  
SHOCK FNDTN IND-SHOCK

STRUCTURAL ARRANGEMENT

BOT PLATE LIMIT IND-CALC

STIFFENERS

STIFFENER SHAPE IND-CALC

DKHS GEOM FACTORS

DKHS GEOM IND -GENERATE  
DKHS SIZE IND -AUTO X

DKHS MATERIALS

DKHS MTRL TYPE IND-HTS  
FIRE PROTECT IND -NONE

DKHS LOADS

BLAST RESIST IND-7 PSI

ARRANGEMENT TYPES

MECH CL ARR IND -  
MECH PORT ARR IND -  
MECH STBD ARR IND -  
ELECT PG ARR 1 IND-M-PG  
ELECT PG ARR 2 IND-  
ELECT DL ARR IND -MTR

ARRANGEMENT CG

MACHY KG IND -GIVEN

ENGINE CONFIG FACTORS

ENG ENDUR RPM IND -CALC  
SEC ENG USAGE IND -  
ENDUR CONFIG IND -NO TS  
GT ENG ENCL IND -NONE  
DIESEL ENG MOUNT IND-NONE

GEARS

SEC ENG 2 SPD GEAR IND-  
GEAR IMPED MASS IND -NONE

PROPULSION SHAFTING

SHAFT SUPPORT TYPE IND-POD  
SHAFT SYS SIZE IND -CALC

PROPULSION SHAFT BEARING

THRUST BRG LOC IND-CALC

PROPELLER FACTORS

PROP TYPE IND -FP  
PROP SERIES IND-ANALYTIC  
PROP DIA IND -CALC  
PROP AREA IND -CALC  
PROP LOC IND -CALC  
PITCH RATIO IND-CALC

OPEN WATER PROP DATA

PROP ID IND -ANY

PROPULSION SUPPORT SYS

INLET TYPE IND -PLENUM  
DUCT SILENCING IND -BOTH  
EXHAUST IR SUPP IND-NONE

SS GENERATOR FACTORS

SS SYS TYPE IND-PD  
FREQ CONV IND -NEW

SS GENERATOR SIZE

SS GEN SIZE IND-NON STD

SS ENGINES

SS ENG SELECT IND -GIVEN  
SS ENG MODEL IND -MTU-12V538  
SS ENG TYPE IND -F DIESEL  
SS ENG SFC EQN IND-DIESEL  
SS ENG SIZE IND -CALC

SONAR SYSTEM

SONAR DOME IND -NONE  
SONAR DRAG IND -

CLIMATE CONTROL

COLL PROTECT SYS IND-PRESENT  
REFER MACHY LOC IND -INSIDE  
AUX BOILER TYPE IND -ELECTRIC

SEA WATER SYSTEMS

AIR AND MISC FLUID SYSTEM

RUDDERS

RUDDER SIZE IND-CALC  
RUDDER TYPE IND-INTEGRAL

ROLL FINS

FIN SIZE IND -CALC

REPLENISHMENT SYSTEMS

# MAIN ENGINES

MAIN ENG SELECT IND-GIVEN  
 MAIN ENG MOD IND -OTHER  
 MAIN ENG TYPE IND -D DIESEL  
 MAIN ENG SFC EQ IND-DIESEL  
 MAIN ENG SIZE IND -GIVEN

# SEC ENGINES

SEC ENG SELECT IND -  
 SEC ENG MODEL IND -  
 SEC ENG TYPE IND -  
 SEC ENG SFC EQN IND-  
 SEC ENG SIZE IND -

# TRANSMISSION FACTORS

TRANS TYPE IND -ELECT  
 TRANS EFF IND -CALC

# ELECTRICAL TRANSMISSION

ELECT PRPLN TYPE IND -ACR-DCS  
 ELECT PRPLN RATIND IND-GIVEN  
 AC SYNC ROTOR COOL IND-AIR  
 TRANS LINE NODE PT IND-CALC  
 SWITCHGEAR TYPE IND -ADV

# SPECIAL PURPOSE SYSTEMS

POLLUTION CNTL IND-PRESENT  
 OUTFIT AND FURNISHINGS  
 UNIT CMDR IND -NONE

# FUELS AND LUBRICANTS

SHIP FUEL TYPE IND-DFM

# RESISTANCE FACTORS

FRICTION LINE IND -ITTC  
 RESID RESIST IND -NRC  
 WORM CURVE IND -DD CALC  
 PRPLN SYS RESIST IND-CALC

# SHIP WEIGHT

SHIP LCG INPUT IND-CALC

# PRINTED REPORT NO. 4 - MARGINS

# HULL

MIN FREEBOARD MARGIN, FT .25  
 HULL MARGIN STRESS, KSI 2.24

# PROPULSION PLANT

TORQUE MARGIN FAC 1.200

# ELECTRIC PLANT

ELECT LOAD DES MARGIN FAC .200  
 ELECT LOAD SL MARGIN FAC .100

# AUXILIARY SYSTEMS

AC MARGIN FAC .200

# OUTFIT AND FURNISHINGS

CREW ACCOM MARGIN FAC .100

# WEIGHT MARGINS

GROWTH WT MARGIN, LTON .0  
 D+B WT MARGIN, LTON .0  
 D+B WT MARGIN FAC .125  
 D+B KG MARGIN, FT .00  
 D+B KG MARGIN FAC .125

# RESISTANCE FACTORS

DRAG MARGIN FAC .080

# SPACE FACTORS

SPACE MARGIN FAC .050  
 PASSWAY MARGIN FAC .000  
 TANKAGE MARGIN FAC .000

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW PAYLOAD AND ADJUSTMENT NAME

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=====
1  CIC COMMAND AND DECISION MODFIG
2  EXCOMM (1/2 DDG51)
3  NAV SYS (1/2 DDG 51)
4  SPS-67 SSR
5  SPY-3C (MINI-SPY)
6  MK XII AIMS IFF
7  LUBE OIL SYS REDUCTION
8  SLQ-25 NIXIE
9  SLQ-32(V)3 ACTIVE/PASSIVE ECM
10 DESULFERIZER
11 CS HOLD UP BATTERY
12 SENSOR COOLING SYSTEMS
13 HELO HANGAR
14 CRANE
15 BALLAST
16 OPER READINESS AND TEST SYS
17 RAST/TALON HELO COMBO
18 RAST CONTROL STATION
19 LAMPS MKIV: AVIATION SUPPORT & SPARES
20 VSCF CYCLO AND GENS REDUCTION
21 1X 40MM CIWS/MULTI PURP GUN
22 1X 40MM CIWS/MULTI PURP GUN
23 21 CELL RAM LAUNCHER
24 LONGITUDNAL BULKHEADS AROUND MAGAZINE
26 40MM AMMO (MIXED) 3000 RNDs
27 40MM AMMO (MIXED) -- 3000 RNDs
29 HELO AS565 PANTHER: (DOLPHIN)
30 LAMPS MKIII: FUEL [JP-5]
32 ADMIN LAN
34 AVIATION STORES
36 MINE DETECTION HULL MOUNTED SONAR

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ROW	WT KEY	WT ADD LTON	WT FAC	VCG KEY	VCG ADD FT	VCG FAC
===	====	=====	=====	=====	=====	=====
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
7	W262	-23.06	.000	BL	10.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
10	W261	7.70	.000	BL	10.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W588	10.00	.000	BL	40.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000
15	W191	1.00	.000	BL	1.00	1.000

16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
20	W311	-20.50	.000	BL	7.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000
22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000

ROW	AREA KEY	---AREA ADD, FT2---		-----AREA FAC-----	
		HULL/SS	SS/ONLY	HULL/SS	SS/ONLY
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
7	NONE	.00	-100.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
10	NONE	.00	93.50	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	A1312	.00	600.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
20	NONE	-250.00	.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

ROW	KW	-----KW ADD, KW-----			-----KW FAC-----		
	KEY	W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
7	NONE	-5.00	-10.00	-5.00	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
10	NONE	5.00	10.00	5.00	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000
13	NONE	5.00	10.00	5.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000
17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	.00	.00	.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000



## APPENDIX G. 12.0 MEGAWATT MCFC MODEL SUMMARY

This appendix contains the summary reports of each module for the 100% power MCFC model. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.30.17.

PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	54.00
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-OPTIMUM	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	385.00	PRISMATIC COEF	0.570
LOA, FT	405.49	MAX SECTION COEF	0.795
BEAM, FT	50.91	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	55.09	LCB/LCP	0.515
DRAFT, FT	17.01	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.68	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.47	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.77	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	21.45	BARE HULL DISPL, LTON	4319.96
STABILITY BEAM, FT	50.91	AREA BEAM, FT	48.69

### BARE HULL DATA ON LWL

LGTH ON WL, FT	385.00
BEAM, FT	50.91
DRAFT, FT	17.01
FREEBOARD @ STA 3, FT	21.46
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	14392.24
WETTED SURFACE, FT2	19983.28
BARE HULL DISPL, LTON	4322.43
APPENDAGE DISPL, LTON	107.56
FULL LOAD WT, LTON	4429.99
HULL GEOM MODULE	

### STABILITY DATA ON LWL

KB, FT	10.45
BMT, FT	14.88
KG, FT	19.63
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	5.09
GML, FT	771.57
GMT/B AVAIL	0.100
GMT/B REQ	0.100

1.875 CPU SECONDS.



ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.30.18.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	385.00	HULL AVG DECK HT, FT	10.77
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	450132.	NO TRANS BHDS	11
MR VOLUME, FT3	42192.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	29696.	NO MACHY RMS	3
EXCESS TANKAGE, FT3	7769.	NO PROP SHAFTS	2
ARR AREA LOST TANKS, FT2	22.3		
HULL ARR AREA AVAIL, FT2	34879.5		
HULL SUBDIV MODULE	0.750 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.30.19.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	385.00	DKHS LENGTH OA, FT	167.37
BEAM, FT	50.91	DKHS MAX WIDTH, FT	55.41
AREA BEAM, FT	48.69	DKHS HT (W/O PLTHS), FT	46.68
DKHS FWD LIMIT- STA	4.0	OTHER ARR AREA REQ, FT2	38959.39
DKHS AFT LIMIT- STA	12.7	HULL ARR AREA AVAIL, FT2	34879.47
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	5096.35
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	606.58
DKHS AVG SIDE ANG, DEG	10.00		
DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	11142.06
DKHS ARR AREA DERIV, FT2	198.84	DKHS ARR AREA AVAIL, FT2	9268.52
DKHS MIN ALW BEAM, FT	20.55	DKHS VOLUME, FT3	94002.25
BRIDGE L-O-S OVER BOW, FT	289.70		
		DKHS WEIGHT, LTON	180.68
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	40.70
DKHS SIDE ANG OFFSET, DEG			
DKHS DECK HT OFFSET, FT			
DECKHOUSE MODULE	1.000 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.30.20.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT  
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

----- HULL STRENGTH AND STRESS -----

HOGGING BM, FT-LTON	67672.	PRIM STRESS KEEL-HOG, KSI	13.81
SAGGING BM, FT-LTON	56418.	PRIM STRESS KEEL-SAG, KSI	11.52
MIDSHIP MOI, FT2-IN2	185742.	PRIM STRESS DECK-HOG, KSI	13.94
DIST N.A. TO KEEL, FT	16.92	PRIM STRESS DECK-SAG, KSI	11.62
DIST N.A. TO DECK, FT	17.08	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN2	10975.	SEC MOD TO DECK, FT-IN2	10873.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	3	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		11

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	849.0	21.02
110	SHELL+SUPPORT	423.9	15.95
120	HULL STRUCTURAL BHD	86.6	20.41
130	HULL DECKS	255.3	31.18
140	HULL PLATFORM/FLATS	83.2	16.29

HULL STRUCT MODULE 1.375 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - APPENDAGE MODULE - 5/31/96 08.30.22.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 107.6

SHELL DISP, LTON 15.7

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	13.3	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8804	AVG RUDDER CHORD, FT	6.32
SKEG THK, FT	1.00	RUDDER THK, FT	0.86
SKEG PROJECTED AREA, FT2	464.2	RUDDER SPAN, FT	21.20
		RUDDER PROJECTED AREA, FT2	133.9
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	3.8
BILGE KEEL DISP, LTON	5.9		
BILGE KEEL LGTH, FT	90.96	FIN SIZE IND	CALC

SHAFT SUPPORT TYPE IND	POD	NO FIN PAIRS	1
SHAFT SUPPORT DISP, LTON	61.6	FWD FIN	
SHAFT DISP, LTON	0.0	CHORD, FT	10.27
		THK, FT	1.54
		SPAN, FT	10.27
PROP TYPE IND	FP	PROJECTED AREA, FT2	105.4
PROP BLADE DISP, LTON	1.1	DISP, LTON (PER PAIR)	6.2
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	13.90	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.250 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.30.23.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	4430.0	CORR ALW	0.00050
AVG ENDUR DISP, LTON	4182.4	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	572.1	TRAILSHAFT PWR FAC	1.15
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.203
NO PROP SHAFTS	2.	SUSTN SPEED	0.226
PROP DIA, FT	13.90	ENDUR SPEED	0.475

CONDITION	SPEED-----KT	FRIC	RESID	APPDGE	WIND	MARGIN	TOTAL	DRAG LBF
MAX	26.00	6047.	9742.	4222.	238.	1620.	21869.	274103.
SUSTN	25.00	5396.	7113.	3699.	212.	1314.	17733.	231141.
ENDUR	14.00	975.	451.	813.	38.	182.	2458.	57214.
RESISTANCE MODULE				1.125 CPU SECONDS.				

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.30.24.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	ANY
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL
MAX SPEED, KT	26.00	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	10934.	ENDUR EHP (/SHAFT), HP	1229.

MAX SHP (/SHAFT), HP	14916.	ENDUR SHP (/SHAFT), HP	1618.
MAX PROP RPM	170.0	ENDUR PROP RPM	85.2
MAX PROP EFF	0.733	ENDUR PROP EFF	0.760
SUSTN SPEED, KT	25.00	PROP DIA, FT	13.90
SUSTN EHP (/SHAFT), HP	8866.	NO BLADES	5.
SUSTN SHP (/SHAFT), HP	11951.	PITCH RATIO	1.36
SUSTN PROP RPM	160.1	EXPAND AREA RATIO	0.727
SUSTN PROP EFF	0.742	CAVITATION NO	1.76
NO PROP SHAFTS	2.0		
TOTAL PROPELLER WT, LTON	21.17		
PROPELLER MODULE	0.875 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.30.26.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	26.00
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2741.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1159.	USABLE FUEL WT, LTON	572.1
SWBS 200 GROUP WT, LTON	618.1	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	138.4		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	1800. KW	1	0	0
VSCF SS CYCLO	3007. KW	2	2	1

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	OTHER		MTU-12V538
ENG TYPE IND	D DIESEL		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	2	0	1
ENG PWR AVAIL, HP	15845.		2512.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.371		.342
ENG LOAD FRAC	1.166		1.000
MACHINERY MODULE	2.250 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.30.28.  
 PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	385.0	TOTAL ACCOM	122.0
BEAM, FT	50.9	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	44148.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	544134.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	572.1	WATER HTR TYPE IND	INSTANT
FULL LOAD WT, LTON	4430.0	ANCHOR LOC IND	BOTTOM
MAX SHP, HP	31691.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 1800.0 KW  
 PD GEN: VSCF @ 6014.5 KW

TOTAL AIRCOND LOAD, TON	165.8	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT, LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT, LTON	0.3
BOAT SELECT IND	GIVEN		
BOAT TYPE IND	MIXED		
BOAT COMPLEMENT	2 RIB+UB/UB	NO FAS STATIONS	2.
SWBS 583 WT, LTON	35.6	RAS STATIONS:	NO TYPE
			2.

BULKHEAD

SSCS 3.53 AREA, FT2	244.0
STRIKE GEAR: NO TYPE	SWBS 571 WT, LTON 10.7
2. PALLET	
STRK DECK AREA, FT2	430.0
SWBS 572 WT, LTON	35.6
STOWAGE AREA, FT2	1455.6
SWBS 671 WT, LTON	2.1
SWBS 672 WT, LTON	13.2

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.30.29.

PRINTED REPORT NO. 1 - SUMMARY

SWBS	G R O U P	W E I G H T		LCG	VCG	RESULTANT ADJ	
		LTON	PER CENT	FT	FT	WT-LTON	VCG-FT
100	HULL STRUCTURE	1454.9	32.8	192.04	21.85	1.0	.00
200	PROP PLANT	618.1	14.0	237.76	9.50		
300	ELECT PLANT	138.4	3.1	346.13	25.00		
400	COMM + SURVEIL	134.2	3.0	146.30	27.67	82.8	.49
500	AUX SYSTEMS	574.9	13.0	211.75	22.82	20.0	.18
600	OUTFIT + FURN	325.1	7.3	192.50	22.58		
700	ARMAMENT	20.6	0.5	173.25	37.45	16.2	.15
M11	D+B WT MARGIN	408.2	9.2	208.74	20.23		
	D+B KG MARGIN			+	2.53		
=====							
L I G H T S H I P		3674.4	82.9	208.74	22.76	120.0	.82
=====							

F00	FULL LOADS	755.5	17.1	147.39	4.42	85.0	.20
F10	CREW + EFFECTS	13.0		180.95	25.91		
F20	MISS REL EXPEN	21.2		169.40	12.18		
F30	SHIPS STORES	17.4		207.90	19.44		
F40	FUELS + LUBRIC	685.8		143.53	3.38		
F50	FRESH WATER	18.1			4.89		
F60	CARGO						
M24	FUTURE GROWTH						

FULL LOAD WT	4430.0	100.0	198.27	19.63	205.0	1.02
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WEIGHT MODULE 1.500 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.30.31.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	4430.0	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	10.77	AC MARGIN FAC	0.200
MR VOLUME, FT3	42192.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
DKHS ONLY	1591.0	5096.1	9268.5	94002.
HULL OR DKHS	2670.0	38959.6	34879.5	450132.
TOTAL	4261.0	44055.7	44148.0	544134.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
1.	MISSION SUPPORT	5626.5	2208.0	12.8
2.	HUMAN SUPPORT	7923.7	381.5	18.0
3.	SHIP SUPPORT	12000.8	1431.7	27.2
4.	SHIP MOBILITY SYSTEM	16406.8	832.2	37.2
5.	UNASSIGNED	2097.9	242.7	4.8

TOTAL	44055.7	5096.1	100.0
SPACE MODULE	1.500 CPU SECONDS.		

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE  
MOLTEN CARBONATE  
12.0 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT	
LBP	385.0
LOA	405.5
BEAM, DWL	50.9
BEAM, WEATHER DECK	55.1
DEPTH @ STA 10	34.0
DRAFT TO KEEL DWL	17.0
DRAFT TO KEEL LWL	17.0
FREEBOARD @ STA 3	21.5
GMT	5.1
CP	0.570
CX	0.795

SPEED(KT): MAX= 26.0 SUST= 25.0  
ENDURANCE: 8000.0 NM AT 14.0 KTS

TRANSMISSION TYPE: ELECT  
MAIN ENG: 2 D DIESEL @ 15845.3 HP

SHAFT POWER/SHAFT: 14916.3 HP  
PROPELLERS: 2 - FP - 13.9 FT DIA

SEP GEN: 1 F DIESEL @ 1800.0 KW  
PD GEN: 2 VSCF @ 3007.3 KW

24 HR LOAD 1159.3  
MAX MARG ELECT LOAD 2740.8

	OFF	CPO	ENL	TOTAL
MANNING	15	13	82	110
ACCOM	17	15	90	122

WEIGHT SUMMARY - LTON	
GROUP 1 - HULL STRUCTURE	1454.9
GROUP 2 - PROP PLANT	618.1
GROUP 3 - ELECT PLANT	138.4
GROUP 4 - COMM + SURVEIL	134.2
GROUP 5 - AUX SYSTEMS	574.9
GROUP 6 - OUTFIT + FURN	325.1
GROUP 7 - ARMAMENT	20.6

SUM GROUPS 1-7	3266.3
DESIGN MARGIN	408.2

LIGHTSHIP WEIGHT	3674.4
LOADS	755.5

FULL LOAD DISPLACEMENT	4430.0
FULL LOAD KG: FT	19.6

MILITARY PAYLOAD WT - LTON	201.5
USABLE FUEL WT - LTON	572.1

AREA SUMMARY - FT2	
HULL AREA	34879.5
SUPERSTRUCTURE AREA	9268.5

TOTAL AREA	44148.0
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VOLUME SUMMARY - FT3	
HULL VOLUME	450131.8
SUPERSTRUCTURE VOLUME	94002.3

TOTAL VOLUME	544134.0
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PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
TOTAL	99.	11.	0.	110.	122.

PRINTED REPORT NO. 3 - INDICATORS

MISSION

DESIGN MODE IND-ENDURANCE  
ENDUR DISP IND -AVG DISP  
ENDUR DEF IND -USN  
SUSTN SPEED IND-GIVEN  
ENDUR SPEED IND-GIVEN

HULL FORM FACTORS

HULL OFFSETS IND-GENERATE  
HULL DIM IND -B+T

HULL BOUNDARY CONDITIONS

HULL BC IND -CONV DD  
HULL STA IND -OPTIMUM

SHELL APPENDAGES

BILGE KEEL IND -PRESENT  
SKEG IND -PRESENT

MARGIN LINE

MARGIN LINE IND-CALC

HULL SUBDIVISION FACTORS

HULL SUBDIV IND-GIVEN

INNER BOTTOM

INNER BOTTOM IND-PRESENT

HULL LOADS

HULL LOADS IND -CALC  
SHOCK FNDTN IND-SHOCK

STRUCTURAL ARRANGEMENT

BOT PLATE LIMIT IND-CALC

STIFFENERS

STIFFENER SHAPE IND-CALC

DKHS GEOM FACTORS

DKHS GEOM IND -GENERATE  
DKHS SIZE IND -AUTO X

DKHS MATERIALS

DKHS MTRL TYPE IND-HTS  
FIRE PROTECT IND -NONE

DKHS LOADS

BLAST RESIST IND-7 PSI

ARRANGEMENT TYPES

MECH CL ARR IND -  
MECH PORT ARR IND -  
MECH STBD ARR IND -  
ELECT PG ARR 1 IND-M-PG  
ELECT PG ARR 2 IND-  
ELECT DL ARR IND -MTR

ARRANGEMENT CG

MACHY KG IND -GIVEN

ENGINE CONFIG FACTORS

ENG ENDUR RPM IND -CALC  
SEC ENG USAGE IND -  
ENDUR CONFIG IND -NO TS  
GT ENG ENCL IND -NONE  
DIESEL ENG MOUNT IND-NONE

GEARS

SEC ENG 2 SPD GEAR IND-  
GEAR IMPED MASS IND -NONE

PROPULSION SHAFTING

SHAFT SUPPORT TYPE IND-POD  
SHAFT SYS SIZE IND -CALC

PROPULSION SHAFT BEARING

THRUST BRG LOC IND-CALC

PROPELLER FACTORS

PROP TYPE IND -FP  
PROP SERIES IND-ANALYTIC  
PROP DIA IND -CALC  
PROP AREA IND -CALC  
PROP LOC IND -CALC  
PITCH RATIO IND-CALC

OPEN WATER PROP DATA

PROP ID IND -ANY

PROPULSION SUPPORT SYS

INLET TYPE IND -PLENUM  
DUCT SILENCING IND -BOTH  
EXHAUST IR SUPP IND-NONE

SS GENERATOR FACTORS

SS SYS TYPE IND-PD  
FREQ CONV IND -NEW

SS GENERATOR SIZE

SS GEN SIZE IND-NON STD

SS ENGINES

SS ENG SELECT IND -GIVEN  
SS ENG MODEL IND -MTU-12V538  
SS ENG TYPE IND -F DIESEL  
SS ENG SFC EQN IND-DIESEL  
SS ENG SIZE IND -CALC

SONAR SYSTEM

SONAR DOME IND -NONE  
SONAR DRAG IND -

CLIMATE CONTROL

COLL PROTECT SYS IND-PRESENT  
REFER MACHY LOC IND -INSIDE  
AUX BOILER TYPE IND -ELECTRIC

SEA WATER SYSTEMS

AIR AND MISC FLUID SYSTEM

RUDDERS

RUDDER SIZE IND-CALC  
RUDDER TYPE IND-INTEGRAL

ROLL FINS

FIN SIZE IND -CALC

REPLENISHMENT SYSTEMS



# MAIN ENGINES

MAIN ENG SELECT IND-GIVEN  
 MAIN ENG MOD IND -OTHER  
 MAIN ENG TYPE IND -D DIESEL  
 MAIN ENG SFC EQ IND-DIESEL  
 MAIN ENG SIZE IND -GIVEN

# SEC ENGINES

SEC ENG SELECT IND -  
 SEC ENG MODEL IND -  
 SEC ENG TYPE IND -  
 SEC ENG SFC EQN IND-  
 SEC ENG SIZE IND -

# TRANSMISSION FACTORS

TRANS TYPE IND -ELECT  
 TRANS EFF IND -CALC

# ELECTRICAL TRANSMISSION

ELECT PRPLN TYPE IND -ACR-DCS  
 ELECT PRPLN RATIND IND-GIVEN  
 AC SYNC ROTOR COOL IND-AIR  
 TRANS LINE NODE PT IND-CALC  
 SWITCHGEAR TYPE IND -ADV

# SPECIAL PURPOSE SYSTEMS

POLLUTION CNTL IND-PRESENT  
 OUTFIT AND FURNISHINGS  
 UNIT CMDR IND -NONE

# FUELS AND LUBRICANTS

SHIP FUEL TYPE IND-DFM

# RESISTANCE FACTORS

FRICTION LINE IND -ITT  
 RESID RESIST IND -NRC  
 WORM CURVE IND -DD CALC  
 PRPLN SYS RESIST IND-CALC

# SHIP WEIGHT

SHIP LCG INPUT IND-CALC

# PRINTED REPORT NO. 4 - MARGINS

# HULL

MIN FREEBOARD MARGIN, FT .25  
 HULL MARGIN STRESS, KSI 2.24

# PROPULSION PLANT

TORQUE MARGIN FAC 1.200

# ELECTRIC PLANT

ELECT LOAD DES MARGIN FAC .200  
 ELECT LOAD SL MARGIN FAC .100

# AUXILIARY SYSTEMS

AC MARGIN FAC .200

# OUTFIT AND FURNISHINGS

CREW ACCOM MARGIN FAC .100

# WEIGHT MARGINS

GROWTH WT MARGIN, LTON .0  
 D+B WT MARGIN, LTON .0  
 D+B WT MARGIN FAC .125  
 D+B KG MARGIN, FT .00  
 D+B KG MARGIN FAC .125

# RESISTANCE FACTORS

DRAG MARGIN FAC .080

# SPACE FACTORS

SPACE MARGIN FAC .050  
 PASSWAY MARGIN FAC .000  
 TANKAGE MARGIN FAC .000

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW	PAYLOAD AND ADJUSTMENT NAME
===	=====
1	CIC COMMAND AND DECISION MODFIG
2	EXCOMM (1/2 DDG51)
3	NAV SYS (1/2 DDG 51)
4	SPS-67 SSR
5	SPY-3C (MINI-SPY)
6	MK XII AIMS IFF
7	LUBE OIL SYS REDUCTION
8	SLQ-25 NIXIE
9	SLQ-32(V)3 ACTIVE/PASSIVE ECM
10	DESULFERIZER
11	CS HOLD UP BATTERY
12	SENSOR COOLING SYSTEMS
13	HANGAR
14	CRANE
15	BALLAST
16	OPER READINESS AND TEST SYS
17	RAST/TALON HELO COMBO
18	RAST CONTROL STATION
19	LAMPS MKIV: AVIATION SUPPORT & SPARES
20	VSCF GENS AND CYCLO REDUCTION
21	1X 40MM CIWS/MULTI PURP GUN
22	1X 40MM CIWS/MULTI PURP GUN
23	21 CELL RAM LAUNCHER
24	LONGITUDNAL BULKHEADS AROUND MAGAZINE
26	40MM AMMO (MIXED) 3000 RNDs
27	40MM AMMO (MIXED) -- 3000 RNDs
29	HELO AS565 PANTHER: (DOLPHIN)
30	LAMPS MKIII: FUEL [JP-5]
32	ADMIN LAN
34	AVIATION STORES
36	MINE DETECTION HULL MOUNTED SONAR

ROW	WT KEY	WT ADD	WT FAC	VCG KEY	VCG ADD	VCG FAC
===	=====	LTON	=====	=====	FT	=====
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
7	W262	-24.30	.000	BL	10.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
10	W261	8.30	.000	BL	10.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W588	10.00	.000	BL	40.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000

15	W191	1.00	.000	BL	1.00	1.000
16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
20	W311	-20.50	.000	BL	7.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000
22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000

ROW	AREA KEY	---AREA ADD, FT2-- HULL/SS	SS/ONLY	-----AREA FAC----- HULL/SS	SS/ONLY
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
7	NONE	-100.00	.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
10	NONE	94.08	.00	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	A1312	.00	600.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
20	NONE	-250.00	.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

ROW	KW	-----KW ADD, KW-----			-----KW FAC-----		
	KEY	W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
7	NONE	-5.00	-10.00	-5.00	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
10	NONE	5.00	10.00	5.00	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000
13	NONE	5.00	10.00	5.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000
17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	.00	.00	.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000



## APPENDIX H. 13.2 MEGAWATT MCFC MODEL SUMMARY

This appendix contains the summary reports of each module for the 110% power MCFC model. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.33.09.

PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	54.00
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-OPTIMUM	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	400.00	PRISMATIC COEF	0.570
LOA, FT	420.50	MAX SECTION COEF	0.795
BEAM, FT	50.96	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	55.08	LCB/LCP	0.515
DRAFT, FT	17.22	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.90	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.60	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.80	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	21.37	BARE HULL DISPL, LTON	4548.15
STABILITY BEAM, FT	50.96	AREA BEAM, FT	49.72

### BARE HULL DATA ON LWL

LGTH ON WL, FT	400.00
BEAM, FT	50.96
DRAFT, FT	17.22
FREEBOARD @ STA 3, FT	21.38
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	14963.37
WETTED SURFACE, FT2	20878.23
BARE HULL DISPL, LTON	4550.75
APPENDAGE DISPL, LTON	110.92
FULL LOAD WT, LTON	4661.66
HULL GEOM MODULE	2.000 CPU SECONDS.

### STABILITY DATA ON LWL

KB, FT	10.58
BMT, FT	14.74
KG, FT	19.62
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	5.10
GML, FT	822.28
GMT/B AVAIL	0.100
GMT/B REQ	0.100

ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.33.10.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	400.00	HULL AVG DECK HT, FT	11.40
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	466304.	NO TRANS BHDS	11
MR VOLUME, FT3	44069.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	30448.	NO MACHY RMS	3
EXCESS TANKAGE, FT3	4836.	NO PROP SHAFTS	2
ARR AREA LOST TANKS, FT2	25.4		
HULL ARR AREA AVAIL, FT2	34524.8		
HULL SUBDIV MODULE	0.625 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.33.11.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	400.00	DKHS LENGTH OA, FT	191.46
BEAM, FT	50.96	DKHS MAX WIDTH, FT	55.40
AREA BEAM, FT	49.72	DKHS HT (W/O PLTHS), FT	46.69
DKHS FWD LIMIT- STA	4.0	OTHER ARR AREA REQ, FT2	39562.84
DKHS AFT LIMIT- STA	13.6	HULL ARR AREA AVAIL, FT2	34524.82
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	5396.55
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	607.28
DKHS AVG SIDE ANG, DEG	10.00		
DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	11548.67
DKHS ARR AREA DERIV, FT2	224.72	DKHS ARR AREA AVAIL, FT2	10526.57
DKHS MIN ALW BEAM, FT	20.58	DKHS VOLUME, FT3	106820.36
BRIDGE L-O-S OVER BOW, FT	305.72		
		DKHS WEIGHT, LTON	205.31
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	40.48
DKHS SIDE ANG OFFSET, DEG			
DKHS DECK HT OFFSET, FT			
DECKHOUSE MODULE	1.125 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.33.12.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT  
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

----- HULL STRENGTH AND STRESS -----

HOGGING BM, FT-LTON	74518.	PRIM STRESS KEEL-HOG, KSI	14.93
SAGGING BM, FT-LTON	62126.	PRIM STRESS KEEL-SAG, KSI	12.45
MIDSHIP MOI, FT2-IN2	187816.	PRIM STRESS DECK-HOG, KSI	15.29
DIST N.A. TO KEEL, FT	16.80	PRIM STRESS DECK-SAG, KSI	12.75
DIST N.A. TO DECK, FT	17.21	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN2	11177.	SEC MOD TO DECK, FT-IN2	10916.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	3	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		11

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	888.4	20.73
110	SHELL+SUPPORT	453.8	15.81
120	HULL STRUCTURAL BHD	82.9	20.56
130	HULL DECKS	269.9	30.82
140	HULL PLATFORM/FLATS	81.8	14.92

HULL STRUCT MODULE 1.375 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - APPENDAGE MODULE - 5/31/96 08.33.14.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 110.9

SHELL DISP, LTON 15.8

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	14.4	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8838	AVG RUDDER CHORD, FT	6.79
SKEG THK, FT	1.00	RUDDER THK, FT	0.96
SKEG PROJECTED AREA, FT2	504.4	RUDDER SPAN, FT	20.74
		RUDDER PROJECTED AREA, FT2	140.9
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	4.2
BILGE KEEL DISP, LTON	6.3		
BILGE KEEL LGTH, FT	94.50	FIN SIZE IND	GIVEN



SHAFT SUPPORT TYPE IND	POD	NO FIN PAIRS	1
SHAFT SUPPORT DISP, LTON	60.8	FWD FIN	
SHAFT DISP, LTON	0.0	CHORD, FT	11.86
		THK, FT	1.78
		SPAN, FT	10.35
PROP TYPE IND	FP	PROJECTED AREA, FT2	122.7
PROP BLADE DISP, LTON	1.1	DISP, LTON (PER PAIR)	8.3
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	13.65	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.250 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.33.15.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	4661.7	CORR ALW	0.00050
AVG ENDUR DISP, LTON	4406.9	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	588.7	TRAILSHAFT PWR FAC	1.15
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.213
NO PROP SHAFTS	2.	SUSTN SPEED	0.237
PROP DIA, FT	13.65	ENDUR SPEED	0.454

CONDITION	SPEED-----KT	FRIC	RESID	APPDGE	WIND	MARGIN	TOTAL	DRAG LBF
MAX	26.07	6349.	8114.	4143.	239.	1508.	20352.	254352.
SUSTN	25.00	5618.	5817.	3617.	211.	1221.	16484.	214868.
ENDUR	14.00	1015.	455.	816.	38.	186.	2510.	58417.
RESISTANCE MODULE				1.125 CPU SECONDS.				

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.33.16.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	ANY
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL
MAX SPEED, KT	26.07	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	10176.	ENDUR EHP (/SHAFT), HP	1255.

MAX SHP (/SHAFT), HP	13790.	ENDUR SHP (/SHAFT), HP	1656.
MAX PROP RPM	170.0	ENDUR PROP RPM	86.8
MAX PROP EFF	0.738	ENDUR PROP EFF	0.758

SUSTN SPEED, KT	25.00	PROP DIA, FT	13.65
SUSTN EHP (/SHAFT), HP	8242.	NO BLADES	5.
SUSTN SHP (/SHAFT), HP	11049.	PITCH RATIO	1.38
SUSTN PROP RPM	159.9	EXPAND AREA RATIO	0.713
SUSTN PROP EFF	0.746	CAVITATION NO	1.74

NO PROP SHAFTS 2.0

TOTAL PROPELLER WT, LTON 19.51  
PROPELLER MODULE 1.000 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.33.18.

# PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	26.07
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2804.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1195.	USABLE FUEL WT, LTON	588.7
SWBS 200 GROUP WT, LTON	659.2	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	141.8		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	1839. KW	1	0	0
VSCF SS CYCLO	3116. KW	2	2	1

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	OTHER		MTU-12V538
ENG TYPE IND	D DIESEL		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	2	0	1
ENG PWR AVAIL, HP	17430.		2567.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.370		.342
ENG LOAD FRAC	0.993		1.000
MACHINERY MODULE	2.375 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.33.20.

PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	400.0	TOTAL ACCOM	122.0
BEAM, FT	51.0	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	45051.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	573124.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	588.7	WATER HTR TYPE IND	INSTANT
FULL LOAD WT, LTON	4661.7	ANCHOR LOC IND	WEATHER DK
MAX SHP, HP	34861.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 1839.4 KW

PD GEN: VSCF @ 6232.1 KW

TOTAL AIRCOND LOAD, TON	166.6	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT, LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT, LTON	0.3
BOAT SELECT IND	GIVEN		
BOAT TYPE IND	MIXED		
BOAT COMPLEMENT 2 RIB+UB/UB		NO FAS STATIONS	2.
SWBS 583 WT, LTON	35.6	RAS STATIONS: NO	TYPE
		2.	

BULKHEAD

STRIKE GEAR: NO	TYPE	SSCS 3.53 AREA, FT2	271.0
2.	PALLET	SWBS 571 WT, LTON	10.7

STRK DECK AREA, FT2	430.4	STOWAGE AREA, FT2	1465.0
SWBS 572 WT, LTON	37.0	SWBS 671 WT, LTON	2.1
		SWBS 672 WT, LTON	13.4

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.33.21.

PRINTED REPORT NO. 1 - SUMMARY

SWBS	G R O U P	W E I G H T		LCG	VCG	RESULTANT ADJ	
		LTON	PER CENT	FT	FT	WT-LTON	VCG-FT
100	HULL STRUCTURE	1536.9	33.0	198.31	21.84	1.0	.00
200	PROP PLANT	659.2	14.1	241.49	9.08		
300	ELECT PLANT	141.8	3.0	354.00	24.37		
400	COMM + SURVEIL	136.1	2.9	152.00	27.72	82.4	.46
500	AUX SYSTEMS	621.8	13.3	220.00	23.05	20.0	.17
600	OUTFIT + FURN	338.6	7.3	200.00	22.70		
700	ARMAMENT	20.7	0.4	180.00	37.45	16.2	.14
M11	D+B WT MARGIN	431.8	9.3	215.07	20.14		
	D+B KG MARGIN			+	2.52		
=====							
L I G H T S H I P		3886.8	83.4	215.07	22.66	119.6	.78
=====							

F00	FULL LOADS	774.9	16.6	160.49	4.37	85.0	.19
F10	CREW + EFFECTS	13.0		188.00	25.95		
F20	MISS REL EXPEN	21.2		176.00	12.20		
F30	SHIPS STORES	17.4		216.00	19.46		
F40	FUELS + LUBRIC	705.1		157.32	3.35		
F50	FRESH WATER	18.1			4.89		
F60	CARGO						
M24	FUTURE GROWTH						

FULL LOAD WT	4661.7	100.0	206.00	19.62	204.6	.97
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WEIGHT MODULE 1.500 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.33.23.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	4661.7	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	11.40	AC MARGIN FAC	0.200
MR VOLUME, FT3	44069.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
DKHS ONLY	1591.0	5396.5	10526.6	106820.
HULL OR DKHS	2670.0	39562.8	34524.8	466304.
TOTAL	4261.0	44959.3	45051.4	573124.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
	1. MISSION SUPPORT	5649.5	2209.2	12.6
	2. HUMAN SUPPORT	7923.7	381.5	17.6
	3. SHIP SUPPORT	12425.3	1598.3	27.6
	4. SHIP MOBILITY SYSTEM	16819.9	950.4	37.4
	5. UNASSIGNED	2140.9	257.0	4.8

TOTAL	44959.3	5396.5	100.0
SPACE MODULE	1.375	CPU SECONDS.	

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

MOLTEN CARBONATE  
13.2 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT	
LBP	400.0
LOA	420.5
BEAM, DWL	51.0
BEAM, WEATHER DECK	55.1
DEPTH @ STA 10	34.0
DRAFT TO KEEL DWL	17.2
DRAFT TO KEEL LWL	17.2
FREEBOARD @ STA 3	21.4
GMT	5.1
CP	0.570
CX	0.795

SPEED(KT): MAX= 26.1 SUST= 25.0  
ENDURANCE: 8000.0 NM AT 14.0 KTS

TRANSMISSION TYPE: ELECT  
MAIN ENG: 2 D DIESEL @ 17430.3 HP

SHAFT POWER/SHAFT: 13790.1 HP  
PROPELLERS: 2 - FP - 13.6 FT DIA

SEP GEN: 1 F DIESEL @ 1839.4 KW  
PD GEN: 2 VSCF @ 3116.0 KW

24 HR LOAD 1194.6  
MAX MARG ELECT LOAD 2804.4

	OFF	CPO	ENL	TOTAL
MANNING	15	13	82	110
ACCOM	17	15	90	122

WEIGHT SUMMARY - LTON	
GROUP 1 - HULL STRUCTURE	1536.9
GROUP 2 - PROP PLANT	659.2
GROUP 3 - ELECT PLANT	141.8
GROUP 4 - COMM + SURVEIL	136.1
GROUP 5 - AUX SYSTEMS	621.8
GROUP 6 - OUTFIT + FURN	338.6
GROUP 7 - ARMAMENT	20.7

SUM GROUPS 1-7	3455.0
DESIGN MARGIN	431.8

LIGHTSHIP WEIGHT	3886.8
LOADS	774.9

FULL LOAD DISPLACEMENT	4661.7
FULL LOAD KG: FT	19.6

MILITARY PAYLOAD WT - LTON	201.5
USABLE FUEL WT - LTON	588.7

AREA SUMMARY - FT2	
HULL AREA	34524.8
SUPERSTRUCTURE AREA	10526.6
TOTAL AREA	45051.4

VOLUME SUMMARY - FT3	
HULL VOLUME	466304.1
SUPERSTRUCTURE VOLUME	106820.4
TOTAL VOLUME	573124.4

PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
TOTAL	99.	11.	0.	110.	122.

PRINTED REPORT NO. 3 - INDICATORS

MISSION

DESIGN MODE IND-ENDURANCE  
ENDUR DISP IND -AVG DISP  
ENDUR DEF IND -USN  
SUSTN SPEED IND-GIVEN  
ENDUR SPEED IND-GIVEN

HULL FORM FACTORS

HULL OFFSETS IND-GENERATE  
HULL DIM IND -B+T

HULL BOUNDARY CONDITIONS

HULL BC IND -CONV DD  
HULL STA IND -OPTIMUM

SHELL APPENDAGES

BILGE KEEL IND -PRESENT  
SKEG IND -PRESENT

MARGIN LINE

MARGIN LINE IND-CALC

HULL SUBDIVISION FACTORS

HULL SUBDIV IND-GIVEN

INNER BOTTOM

INNER BOTTOM IND-PRESENT

HULL LOADS

HULL LOADS IND -CALC  
SHOCK FNDTN IND-SHOCK

STRUCTURAL ARRANGEMENT

BOT PLATE LIMIT IND-CALC

STIFFENERS

STIFFENER SHAPE IND-CALC

DKHS GEOM FACTORS

DKHS GEOM IND -GENERATE  
DKHS SIZE IND -AUTO X

DKHS MATERIALS

DKHS MTRL TYPE IND-HTS  
FIRE PROTECT IND -NONE

DKHS LOADS

BLAST RESIST IND-7 PSI

ARRANGEMENT TYPES

MECH CL ARR IND -  
MECH PORT ARR IND -  
MECH STBD ARR IND -  
ELECT PG ARR 1 IND-M-PG  
ELECT PG ARR 2 IND-  
ELECT DL ARR IND -MTR

ARRANGEMENT CG

MACHY KG IND -GIVEN

ENGINE CONFIG FACTORS

ENG ENDUR RPM IND -CALC  
SEC ENG USAGE IND -  
ENDUR CONFIG IND -NO TS  
GT ENG ENCL IND -NONE  
DIESEL ENG MOUNT IND-NONE

GEARS

SEC ENG 2 SPD GEAR IND-  
GEAR IMPED MASS IND -NONE

PROPULSION SHAFTING

SHAFT SUPPORT TYPE IND-POD  
SHAFT SYS SIZE IND -CALC

PROPULSION SHAFT BEARING

THRUST BRG LOC IND-CALC

PROPELLER FACTORS

PROP TYPE IND -FP  
PROP SERIES IND-ANALYTIC  
PROP DIA IND -CALC  
PROP AREA IND -CALC  
PROP LOC IND -CALC  
PITCH RATIO IND-CALC

OPEN WATER PROP DATA

PROP ID IND -ANY

PROPULSION SUPPORT SYS

INLET TYPE IND -PLENUM  
DUCT SILENCING IND -BOTH  
EXHAUST IR SUPP IND-NONE

SS GENERATOR FACTORS

SS SYS TYPE IND-PD  
FREQ CONV IND -NEW

SS GENERATOR SIZE

SS GEN SIZE IND-NON STD

SS ENGINES

SS ENG SELECT IND -GIVEN  
SS ENG MODEL IND -MTU-12V538  
SS ENG TYPE IND -F DIESEL  
SS ENG SFC EQN IND-DIESEL  
SS ENG SIZE IND -CALC

SONAR SYSTEM

SONAR DOME IND -NONE  
SONAR DRAG IND -

CLIMATE CONTROL

COLL PROTECT SYS IND-PRESENT  
REFER MACHY LOC IND -INSIDE  
AUX BOILER TYPE IND -ELECTRIC

SEA WATER SYSTEMS

AIR AND MISC FLUID SYSTEM

RUDDERS

RUDDER SIZE IND-CALC  
RUDDER TYPE IND-INTEGRAL

ROLL FINS

FIN SIZE IND -GIVEN

REPLENISHMENT SYSTEMS

# MAIN ENGINES

MAIN ENG SELECT IND-GIVEN  
 MAIN ENG MOD IND -OTHER  
 MAIN ENG TYPE IND -D DIESEL  
 MAIN ENG SFC EQ IND-DIESEL  
 MAIN ENG SIZE IND -GIVEN

# SEC ENGINES

SEC ENG SELECT IND -  
 SEC ENG MODEL IND -  
 SEC ENG TYPE IND -  
 SEC ENG SFC EQN IND-  
 SEC ENG SIZE IND -

# TRANSMISSION FACTORS

TRANS TYPE IND -ELECT  
 TRANS EFF IND -CALC

# ELECTRICAL TRANSMISSION

ELECT PRPLN TYPE IND -ACR-DCS  
 ELECT PRPLN RATIND IND-GIVEN  
 AC SYNC ROTOR COOL IND-AIR  
 TRANS LINE NODE PT IND-CALC  
 SWITCHGEAR TYPE IND -ADV

# SPECIAL PURPOSE SYSTEMS

POLLUTION CNTL IND-PRESENT  
 OUTFIT AND FURNISHINGS  
 UNIT CMDR IND -NONE

# FUELS AND LUBRICANTS

SHIP FUEL TYPE IND-DFM

# RESISTANCE FACTORS

FRICTION LINE IND -ITTTC  
 RESID RESIST IND -NRC  
 WORM CURVE IND -DD CALC  
 PRPLN SYS RESIST IND-CALC

# SHIP WEIGHT

SHIP LCG INPUT IND-CALC

# PRINTED REPORT NO. 4 - MARGINS

# HULL

MIN FREEBOARD MARGIN, FT .25  
 HULL MARGIN STRESS, KSI 2.24

# PROPULSION PLANT

TORQUE MARGIN FAC 1.200

# ELECTRIC PLANT

ELECT LOAD DES MARGIN FAC .200  
 ELECT LOAD SL MARGIN FAC .100

# AUXILIARY SYSTEMS

AC MARGIN FAC .200

# OUTFIT AND FURNISHINGS

CREW ACCOM MARGIN FAC .100

# WEIGHT MARGINS

GROWTH WT MARGIN, LTON .0  
 D+B WT MARGIN, LTON .0  
 D+B WT MARGIN FAC .125  
 D+B KG MARGIN, FT .00  
 D+B KG MARGIN FAC .125

# RESISTANCE FACTORS

DRAG MARGIN FAC .080

# SPACE FACTORS

SPACE MARGIN FAC .050  
 PASSWAY MARGIN FAC .000  
 TANKAGE MARGIN FAC .000

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW PAYLOAD AND ADJUSTMENT NAME

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=====
1  CIC COMMAND AND DECISION MODFIG
2  EXCOMM (1/2 DDG51)
3  NAV SYS (1/2 DDG 51)
4  SPS-67 SSR
5  SPY-3C (MINI-SPY)
6  MK XII AIMS IFF
7  LUBE OIL SYS REDUCTION
8  SLQ-25 NIXIE
9  SLQ-32(V)3 ACTIVE/PASSIVE ECM
10 DESULFERIZER
11 CS HOLD UP BATTERY
12 SENSOR COOLING SYSTEMS
13 HANGAR
14 CRANE
15 BALLAST
16 OPER READINESS AND TEST SYS
17 RAST/TALON HELO COMBO
18 RAST CONTROL STATION
19 LAMPS MKIV: AVIATION SUPPORT & SPARES
20 VSCF GENS AND CYCLO REDUCTION
21 1X 40MM CIWS/MULTI PURP GUN
22 1X 40MM CIWS/MULTI PURP GUN
23 21 CELL RAM LAUNCHER
24 LONGITUDNAL BULKHEADS AROUND MAGAZINE
26 40MM AMMO (MIXED) 3000 RNDs
27 40MM AMMO (MIXED) -- 3000 RNDs
29 HELO AS565 PANTHER: (DOLPHIN)
30 LAMPS MKIII: FUEL [JP-5]
32 ADMIN LAN
34 AVIATION STORES
36 MINE DETECTION HULL MOUNTED SONAR
  
```

ROW	WT KEY	WT ADD LTON	WT FAC	VCG KEY	VCG ADD FT	VCG FAC
===	=====	=====	=====	=====	=====	=====
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
7	W262	-25.50	.000	BL	10.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
10	W261	8.80	.000	BL	10.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W588	10.00	.000	BL	40.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000



15	W191	1.00	.000	BL	1.00	1.000
16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
20	W311	-20.50	.000	BL	7.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000
22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000

ROW	AREA KEY	---AREA ADD, FT2-- HULL/SS	SS/ONLY	-----AREA FAC----- HULL/SS	SS/ONLY
===	=====	=====	=====	=====	=====
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
7	NONE	-100.00	.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
10	NONE	102.00	.00	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	A1312	.00	600.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
20	NONE	-250.00	.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

ROW	KW	-----KW ADD, KW-----			-----KW FAC-----		
	KEY	W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
7	NONE	-5.00	-10.00	-5.00	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
10	NONE	5.00	10.00	5.00	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000
13	NONE	5.00	10.00	5.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000
17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	.00	.00	.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000



## APPENDIX I. 10.8 MEGAWATT PAFC MODEL SUMMARY

This appendix contains the summary reports of each module for the 90% power PAFC model. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.34.24.

PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	55.00
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-GIVEN	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	390.00	PRISMATIC COEF	0.570
LOA, FT	408.77	MAX SECTION COEF	0.795
BEAM, FT	51.31	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	55.83	LCB/LCP	0.515
DRAFT, FT	15.61	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.75	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.51	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.78	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	22.90	BARE HULL DISPL, LTON	4046.85
STABILITY BEAM, FT	51.31	AREA BEAM, FT	48.26

### BARE HULL DATA ON LWL

LGTH ON WL, FT	390.00
BEAM, FT	51.31
DRAFT, FT	15.61
FREEBOARD @ STA 3, FT	22.90
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	14692.55
WETTED SURFACE, FT2	19707.92
BARE HULL DISPL, LTON	4049.16
APPENDAGE DISPL, LTON	103.40
FULL LOAD WT, LTON	4152.55
HULL GEOM MODULE	1.625 CPU SECONDS.

### STABILITY DATA ON LWL

KB, FT	9.59
BMT, FT	16.46
KG, FT	20.32
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	5.13
GML, FT	861.33
GMT/B AVAIL	0.100
GMT/B REQ	0.100

ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.34.26.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	390.00	HULL AVG DECK HT, FT	11.39
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	471603.	NO TRANS BHDS	12
MR VOLUME, FT3	36698.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	25239.	NO MACHY RMS	3
EXCESS TANKAGE, FT3	10984.	NO PROP SHAFTS	2
ARR AREA LOST TANKS, FT2	26.3		
HULL ARR AREA AVAIL, FT2	35550.6		
HULL SUBDIV MODULE	0.625 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.34.26.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	390.00	DKHS LENGTH OA, FT	156.95
BEAM, FT	51.31	DKHS MAX WIDTH, FT	56.16
AREA BEAM, FT	48.26	DKHS HT (W/O PLTHS), FT	46.76
DKHS FWD LIMIT-	STA 4.0	OTHER ARR AREA REQ, FT2	39217.86
DKHS AFT LIMIT-	STA 12.0	HULL ARR AREA AVAIL, FT2	35550.59
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	5073.73
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	613.00
DKHS AVG SIDE ANG, DEG	10.00		
DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	11428.66
DKHS ARR AREA DERIV, FT2	188.22	DKHS ARR AREA AVAIL, FT2	8832.86
DKHS MIN ALW BEAM, FT	20.47	DKHS VOLUME, FT3	89568.88
BRIDGE L-O-S OVER BOW, FT	298.46		
		DKHS WEIGHT, LTON	172.16
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	40.88
DKHS SIDE ANG OFFSET, DEG			
DKHS DECK HT OFFSET, FT			
DECKHOUSE MODULE	1.000 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.34.28.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT  
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

----- HULL STRENGTH AND STRESS -----			
HOGGING BM, FT-LTON	70437.	PRIM STRESS KEEL-HOG, KSI	13.58
SAGGING BM, FT-LTON	58723.	PRIM STRESS KEEL-SAG, KSI	11.32
MIDSHIP MOI, FT2-IN2	192327.	PRIM STRESS DECK-HOG, KSI	14.32
DIST N.A. TO KEEL, FT	16.56	PRIM STRESS DECK-SAG, KSI	11.93
DIST N.A. TO DECK, FT	17.45	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN2	11616.	SEC MOD TO DECK, FT-IN2	11021.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	4	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		12

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	861.3	20.58
110	SHELL+SUPPORT	407.0	15.08
120	HULL STRUCTURAL BHD	93.9	20.30
130	HULL DECKS	272.4	30.84
140	HULL PLATFORM/FLATS	87.9	14.58
HULL STRUCT MODULE		1.500 CPU SECONDS.	

ASSET/MONOSC VERSION 3.3+ - APPENDAGE MODULE - 5/31/96 08.34.29.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 103.4

SHELL DISP, LTON 14.8

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	12.6	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8826	AVG RUDDER CHORD, FT	6.12
SKEG THK, FT	1.00	RUDDER THK, FT	0.81
SKEG PROJECTED AREA, FT2	440.1	RUDDER SPAN, FT	20.34
		RUDDER PROJECTED AREA, FT2	124.4
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	3.4
BILGE KEEL DISP, LTON	6.1		
BILGE KEEL LGTH, FT	92.14	FIN SIZE IND	CALC

SHAFT SUPPORT TYPE IND	POD	NO FIN PAIRS	1
SHAFT SUPPORT DISP, LTON	60.1	FWD FIN	
SHAFT DISP, LTON	0.0	CHORD, FT	9.89
		THK, FT	1.48
		SPAN, FT	9.89
PROP TYPE IND	FP	PROJECTED AREA, FT2	97.7
PROP BLADE DISP, LTON	1.0	DISP, LTON (PER PAIR)	5.5
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	13.49	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.375 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.34.30.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	4152.6	CORR ALW	0.00050
AVG ENDUR DISP, LTON	3947.4	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	474.0	TRAILSHAFT PWR FAC	1.15
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.230
NO PROP SHAFTS	2.	SUSTN SPEED	0.257
PROP DIA, FT	13.49	ENDUR SPEED	0.479

CONDITION	SPEED-----KT	FRIC	RESID	APPDG	WIND	MARGIN	TOTAL	DRAG LBF
MAX	26.09	6018.	7660.	4084.	246.	1441.	19449.	242916.
SUSTN	25.00	5315.	5488.	3565.	217.	1167.	15751.	205304.
ENDUR	14.00	964.	476.	819.	39.	184.	2482.	57760.
RESISTANCE MODULE				1.125 CPU SECONDS.				

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.34.31.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	ANY
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL
MAX SPEED, KT	26.09	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	9724.	ENDUR EHP (/SHAFT), HP	1241.

MAX SHP (/SHAFT), HP	13139.	ENDUR SHP (/SHAFT), HP	1639.
MAX PROP RPM	170.0	ENDUR PROP RPM	87.5
MAX PROP EFF	0.740	ENDUR PROP EFF	0.757

SUSTN SPEED, KT	25.00	PROP DIA, FT	13.49
SUSTN EHP (/SHAFT), HP	7875.	NO BLADES	5.
SUSTN SHP (/SHAFT), HP	10529.	PITCH RATIO	1.39
SUSTN PROP RPM	159.9	EXPAND AREA RATIO	0.708
SUSTN PROP EFF	0.748	CAVITATION NO	1.72

NO PROP SHAFTS 2.0

TOTAL PROPELLER WT, LTON 18.66  
PROPELLER MODULE 1.000 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.34.33.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	26.09
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2763.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1168.	USABLE FUEL WT, LTON	474.0
SWBS 200 GROUP WT, LTON	496.3	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	140.9		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	1812. KW	1	0	0
VSCF SS CYCLO	3060. KW	2	2	1

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	OTHER		MTU-12V538
ENG TYPE IND	D DIESEL		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	2	0	1
ENG PWR AVAIL, HP	13857.		2529.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.306		.342
ENG LOAD FRAC	1.196		1.000
MACHINERY MODULE	2.250 CPU SECONDS.		



ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.34.35.

PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	390.0	TOTAL ACCOM	122.0
BEAM, FT	51.3	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	44383.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	561172.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	474.0	WATER HTR TYPE IND	INSTANT
FULL LOAD WT, LTON	4152.6	ANCHOR LOC IND	WEATHER DK
MAX SHP, HP	27713.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 1812.4 KW

PD GEN: VSCF @ 6120.1 KW

TOTAL AIRCOND LOAD, TON	166.4	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT, LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT, LTON	0.3

BOAT SELECT IND	GIVEN
BOAT TYPE IND	MIXED
BOAT COMPLEMENT	2 RIB+UB/UB
SWBS 583 WT, LTON	35.6

NO FAS STATIONS	2.
RAS STATIONS:	NO TYPE
	2.

BULKHEAD

STRIKE GEAR:	NO	TYPE	SSCS 3.53 AREA, FT2	212.9
	2.	PALLET	SWBS 571 WT, LTON	10.7

STRK DECK AREA, FT2	430.2	STOWAGE AREA, FT2	1460.8
SWBS 572 WT, LTON	37.0	SWBS 671 WT, LTON	2.1
		SWBS 672 WT, LTON	13.3

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.34.37.

PRINTED REPORT NO. 1 - SUMMARY

SWBS	GROUP	WEIGHT		LCG	VCG	RESULTANT ADJ	
		LTON	PER CENT	FT	FT	WT-LTON	VCG-FT
100	HULL STRUCTURE	1405.6	33.8	192.43	22.05	1.0	.00
200	PROP PLANT	496.3	12.0	245.53	8.69		
300	ELECT PLANT	140.9	3.4	335.16	24.50		
400	COMM + SURVEIL	135.3	3.3	148.20	27.62	82.6	.52
500	AUX SYSTEMS	586.2	14.1	214.50	23.22	20.0	.20
600	OUTFIT + FURN	328.7	7.9	195.00	22.43		
700	ARMAMENT	20.7	0.5	175.50	37.45	16.2	.16
M11	D+B WT MARGIN	389.1	9.4	209.75	20.64		

D+B KG MARGIN		+	2.58
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L I G H T S H I P	3502.7	84.4	209.75	23.22	119.8	.87
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F00	FULL LOADS	649.9	15.6	152.90	4.70	85.0	.21
F10	CREW + EFFECTS	13.0		183.30	25.92		
F20	MISS REL EXPEN	21.2		171.60	12.19		
F30	SHIPS STORES	17.4		210.60	19.44		
F40	FUELS + LUBRIC	580.1		148.71	3.50		
F50	FRESH WATER	18.1			4.89		
F60	CARGO						
M24	FUTURE GROWTH						

FULL LOAD WT		4152.5	100.0	200.85	20.32	204.8	1.09
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WEIGHT MODULE 1.500 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.34.38.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	4152.5	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	11.39	AC MARGIN FAC	0.200
MR VOLUME, FT3	36698.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
DKHS ONLY	1591.0	5073.7	8832.9	89569.
HULL OR DKHS	2670.0	39217.8	35550.6	471603.
TOTAL	4261.0	44291.6	44383.5	561172.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
	1. MISSION SUPPORT	5645.3	2214.7	12.7
	2. HUMAN SUPPORT	7923.7	381.5	17.9
	3. SHIP SUPPORT	12185.1	1333.3	27.5
	4. SHIP MOBILITY SYSTEM	16428.3	902.6	37.1
	5. UNASSIGNED	2109.1	241.6	4.8
	TOTAL	44291.6	5073.7	100.0

SPACE MODULE 1.500 CPU SECONDS.

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE

PHOSPHORIC ACID

10.8 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP		390.0		GROUP 1 - HULL STRUCTURE	1405.6
LOA		408.8		GROUP 2 - PROP PLANT	496.3
BEAM, DWL		51.3		GROUP 3 - ELECT PLANT	140.9
BEAM, WEATHER DECK		55.8		GROUP 4 - COMM + SURVEIL	135.3
DEPTH @ STA 10		34.0		GROUP 5 - AUX SYSTEMS	586.2
DRAFT TO KEEL DWL		15.6		GROUP 6 - OUTFIT + FURN	328.7
DRAFT TO KEEL LWL		15.6		GROUP 7 - ARMAMENT	20.7
FREEBOARD @ STA 3		22.9		-----	
GMT		5.1		SUM GROUPS 1-7	3113.6
CP		0.570		DESIGN MARGIN	389.1
CX		0.795		-----	
SPEED(KT): MAX= 26.1	SUST= 25.0			LIGHTSHIP WEIGHT	3502.7
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	649.9
TRANSMISSION TYPE: ELECT				-----	
MAIN ENG: 2 D DIESEL @ 13856.6 HP				FULL LOAD DISPLACEMENT	4152.5
SHAFT POWER/SHAFT: 13138.5 HP				FULL LOAD KG: FT	20.3
PROPELLERS: 2 - FP - 13.5 FT DIA				-----	
SEP GEN: 1 F DIESEL @ 1812.4 KW				MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 3060.1 KW				USABLE FUEL WT - LTON	474.0
24 HR LOAD		1168.1		-----	
MAX MARG ELECT LOAD		2762.8		AREA SUMMARY - FT2	
				HULL AREA	- 35550.6
				SUPERSTRUCTURE AREA	- 8832.9
				-----	
				TOTAL AREA	44383.5
				-----	
				VOLUME SUMMARY - FT3	
				HULL VOLUME	- 471602.8
				SUPERSTRUCTURE VOLUME	- 89568.9
				-----	
				TOTAL VOLUME	561171.7

PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
TOTAL	99.	11.	0.	110.	122.

PRINTED REPORT NO. 3 - INDICATORS

MISSION

DESIGN MODE IND-ENDURANCE  
ENDUR DISP IND -AVG DISP  
ENDUR DEF IND -USN  
SUSTN SPEED IND-GIVEN  
ENDUR SPEED IND-GIVEN

HULL FORM FACTORS

HULL OFFSETS IND-GENERATE  
HULL DIM IND -B+T

HULL BOUNDARY CONDITIONS

HULL BC IND -CONV DD  
HULL STA IND -GIVEN

SHELL APPENDAGES

BILGE KEEL IND -PRESENT  
SKEG IND -PRESENT

MARGIN LINE

MARGIN LINE IND-CALC

HULL SUBDIVISION FACTORS

HULL SUBDIV IND-GIVEN

INNER BOTTOM

INNER BOTTOM IND-PRESENT

HULL LOADS

HULL LOADS IND -CALC  
SHOCK FNDTN IND-SHOCK

STRUCTURAL ARRANGEMENT

BOT PLATE LIMIT IND-CALC

STIFFENERS

STIFFENER SHAPE IND-CALC

DKHS GEOM FACTORS

DKHS GEOM IND -GENERATE  
DKHS SIZE IND -AUTO X

DKHS MATERIALS

DKHS MTRL TYPE IND-HTS  
FIRE PROTECT IND -NONE

DKHS LOADS

BLAST RESIST IND-7 PSI

ARRANGEMENT TYPES

MECH CL ARR IND -  
MECH PORT ARR IND -  
MECH STBD ARR IND -  
ELECT PG ARR 1 IND-M-PG  
ELECT PG ARR 2 IND-  
ELECT DL ARR IND -MTR

ARRANGEMENT CG

MACHY KG IND -GIVEN

ENGINE CONFIG FACTORS

ENG ENDUR RPM IND -CALC  
SEC ENG USAGE IND -  
ENDUR CONFIG IND -NO TS  
GT ENG ENCL IND -NONE  
DIESEL ENG MOUNT IND-NONE

GEARS

SEC ENG 2 SPD GEAR IND-  
GEAR IMPED MASS IND -NONE

PROPULSION SHAFTING

SHAFT SUPPORT TYPE IND-POD  
SHAFT SYS SIZE IND -CALC

PROPULSION SHAFT BEARING

THRUST BRG LOC IND-CALC

PROPELLER FACTORS

PROP TYPE IND -FP  
PROP SERIES IND-ANALYTIC  
PROP DIA IND -CALC  
PROP AREA IND -CALC  
PROP LOC IND -CALC  
PITCH RATIO IND-CALC

OPEN WATER PROP DATA

PROP ID IND -ANY

PROPULSION SUPPORT SYS

INLET TYPE IND -PLENUM  
DUCT SILENCING IND -BOTH  
EXHAUST IR SUPP IND-NONE

SS GENERATOR FACTORS

SS SYS TYPE IND-PD  
FREQ CONV IND -NEW

SS GENERATOR SIZE

SS GEN SIZE IND-NON STD

SS ENGINES

SS ENG SELECT IND -GIVEN  
SS ENG MODEL IND -MTU-12V538  
SS ENG TYPE IND -F DIESEL  
SS ENG SFC EQN IND-DIESEL  
SS ENG SIZE IND -CALC

SONAR SYSTEM

SONAR DOME IND -NONE  
SONAR DRAG IND -

CLIMATE CONTROL

COLL PROTECT SYS IND-PRESENT

REFER MACHY LOC IND -INSIDE

AUX BOILER TYPE IND -ELECTRIC

SEA WATER SYSTEMS

AIR AND MISC FLUID SYSTEM

RUDDERS

RUDDER SIZE IND-CALC  
RUDDER TYPE IND-INTEGRAL

ROLL FINS

FIN SIZE IND -CALC

REPLENISHMENT SYSTEMS

# MAIN ENGINES

MAIN ENG SELECT IND-GIVEN  
 MAIN ENG MOD IND -OTHER  
 MAIN ENG TYPE IND -D DIESEL  
 MAIN ENG SFC EQ IND-DIESEL  
 MAIN ENG SIZE IND -GIVEN

# SEC ENGINES

SEC ENG SELECT IND -  
 SEC ENG MODEL IND -  
 SEC ENG TYPE IND -  
 SEC ENG SFC EQN IND-  
 SEC ENG SIZE IND -

# TRANSMISSION FACTORS

TRANS TYPE IND -ELECT  
 TRANS EFF IND -CALC

# ELECTRICAL TRANSMISSION

ELECT PRPLN TYPE IND -ACR-DCS  
 ELECT PRPLN RATIND IND-GIVEN  
 AC SYNC ROTOR COOL IND-AIR  
 TRANS LINE NODE PT IND-CALC  
 SWITCHGEAR TYPE IND -ADV

# SPECIAL PURPOSE SYSTEMS

POLLUTION CNTL IND-PRESENT  
 OUTFIT AND FURNISHINGS  
 UNIT CMDR IND -NONE

# FUELS AND LUBRICANTS

SHIP FUEL TYPE IND-DFM

# RESISTANCE FACTORS

FRICTION LINE IND -ITTC  
 RESID RESIST IND -NRC  
 WORM CURVE IND -DD CALC  
 PRPLN SYS RESIST IND-CALC

# SHIP WEIGHT

SHIP LCG INPUT IND-CALC

# PRINTED REPORT NO. 4 - MARGINS

# HULL

MIN FREEBOARD MARGIN, FT .25  
 HULL MARGIN STRESS, KSI 2.24

# PROPULSION PLANT

TORQUE MARGIN FAC 1.200

# ELECTRIC PLANT

ELECT LOAD DES MARGIN FAC .200  
 ELECT LOAD SL MARGIN FAC .100

# AUXILIARY SYSTEMS

AC MARGIN FAC .200

# OUTFIT AND FURNISHINGS

CREW ACCOM MARGIN FAC .100

# WEIGHT MARGINS

GROWTH WT MARGIN, LTON .0  
 D+B WT MARGIN, LTON .0  
 D+B WT MARGIN FAC .125  
 D+B KG MARGIN, FT .00  
 D+B KG MARGIN FAC .125

# RESISTANCE FACTORS

DRAG MARGIN FAC .080

# SPACE FACTORS

SPACE MARGIN FAC .050  
 PASSWAY MARGIN FAC .000  
 TANKAGE MARGIN FAC .000

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW	PAYLOAD AND ADJUSTMENT NAME
1	CIC COMMAND AND DECISION MODFIG
2	EXCOMM (1/2 DDG51)
3	NAV SYS (1/2 DDG 51)
4	SPS-67 SSR
5	SPY-3C (MINI-SPY)
6	MK XII AIMS IFF
7	LUBE OIL SYS REDUCTION
8	SLQ-25 NIXIE
9	SLQ-32(V)3 ACTIVE/PASSIVE ECM
10	DESULFERIZER
11	CS HOLD UP BATTERY
12	SENSOR COOLING SYSTEMS
13	HELO HANGAR
14	CRANE
15	BALLAST
16	OPER READINESS AND TEST SYS
17	RAST/TALON HELO COMBO
18	RAST CONTROL STATION
19	LAMPS MKIV: AVIATION SUPPORT & SPARES
20	VSCF GENS AND CYCLO REDUCTION
21	1X 40MM CIWS/MULTI PURP GUN
22	1X 40MM CIWS/MULTI PURP GUN
23	21 CELL RAM LAUNCHER
24	LONGITUDNAL BULKHEADS AROUND MAGAZINE
26	40MM AMMO (MIXED) 3000 RNDS
27	40MM AMMO (MIXED) -- 3000 RNDS
29	HELO AS565 PANTHER: (DOLPHIN)
30	LAMPS MKIII: FUEL [JP-5]
32	ADMIN LAN
34	AVIATION STORES
36	MINE DETECTION HULL MOUNTED SONAR

ROW	WT KEY	WT ADD LTON	WT FAC	VCG KEY	VCG ADD FT	VCG FAC
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
7	W262	-22.73	.000	BL	10.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
10	W261	4.30	.000	BL	10.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W588	10.00	.000	BL	40.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000

15	W191	1.00	.000	BL	1.00	1.000
16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
20	W311	-20.50	.000	BL	7.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000
22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000

ROW	AREA KEY	---AREA ADD, FT2---		-----AREA FAC-----	
		HULL/SS	SS/ONLY	HULL/SS	SS/ONLY
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
7	NONE	.00	-100.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
10	NONE	.00	93.50	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	A1312	.00	600.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
20	NONE	-250.00	.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

KW -----KW ADD, KW-----KW FAC-----

ROW	KEY	W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
===	===	=====	=====	=====	=====	=====	=====
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
7	NONE	-5.00	-10.00	-5.00	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
10	NONE	5.00	10.00	5.00	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000
13	NONE	5.00	10.00	5.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000
17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	.00	.00	.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000





## APPENDIX J. 12.0 MEGAWATT PAFC MODEL SUMMARY

This appendix contains the summary reports of each module for the 100% power PAFC model. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.35.07.

PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	55.00
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-GIVEN	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	390.00	PRISMATIC COEF	0.570
LOA, FT	408.77	MAX SECTION COEF	0.795
BEAM, FT	51.36	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	55.82	LCB/LCP	0.515
DRAFT, FT	15.83	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.75	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.51	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.78	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	22.67	BARE HULL DISPL, LTON	4109.17
STABILITY BEAM, FT	51.36	AREA BEAM, FT	48.44

### BARE HULL DATA ON LWL

LGTH ON WL, FT	390.00
BEAM, FT	51.36
DRAFT, FT	15.83
FREEBOARD @ STA 3, FT	22.68
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	14707.40
WETTED SURFACE, FT2	19819.78
BARE HULL DISPL, LTON	4111.52
APPENDAGE DISPL, LTON	104.57
FULL LOAD WT, LTON	4216.09
HULL GEOM MODULE	1.750 CPU SECONDS.

### STABILITY DATA ON LWL

KB, FT	9.73
BMT, FT	16.26
KG, FT	20.25
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	5.14
GML, FT	849.26
GMT/B AVAIL	0.100
GMT/B REQ	0.100

ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.35.09.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	390.00	HULL AVG DECK HT, FT	11.24
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	470103.	NO TRANS BHDS	11
MR VOLUME, FT3	38787.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	25020.	NO MACHY RMS	3
EXCESS TANKAGE, FT3	11373.	NO PROP SHAFTS	2
ARR AREA LOST TANKS, FT2	25.4		
HULL ARR AREA AVAIL, FT2	35630.2		
HULL SUBDIV MODULE	0.750 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.35.09.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	390.00	DKHS LENGTH OA, FT	158.83
BEAM, FT	51.36	DKHS MAX WIDTH, FT	56.15
AREA BEAM, FT	48.44	DKHS HT (W/O PLTHS), FT	46.75
DKHS FWD LIMIT- STA	4.0	OTHER ARR AREA REQ, FT2	39445.71
DKHS AFT LIMIT- STA	12.1	HULL ARR AREA AVAIL, FT2	35630.23
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	5026.54
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	613.83
DKHS AVG SIDE ANG, DEG	10.00		
DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	11429.40
DKHS ARR AREA DERIV, FT2	190.11	DKHS ARR AREA AVAIL, FT2	8933.96
DKHS MIN ALW BEAM, FT	20.48	DKHS VOLUME, FT3	90598.26
BRIDGE L-O-S OVER BOW, FT	296.28		
		DKHS WEIGHT, LTON	174.13
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	40.85
DKHS SIDE ANG OFFSET, DEG			
DKHS DECK HT OFFSET, FT			
DECKHOUSE MODULE	1.000 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.35.11.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT  
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

----- HULL STRENGTH AND STRESS -----			
HOGGING BM, FT-LTON	70508.	PRIM STRESS KEEL-HOG, KSI	13.51
SAGGING BM, FT-LTON	58782.	PRIM STRESS KEEL-SAG, KSI	11.27
MIDSHIP MOI, FT2-IN2	193600.	PRIM STRESS DECK-HOG, KSI	14.23
DIST N.A. TO KEEL, FT	16.57	PRIM STRESS DECK-SAG, KSI	11.86
DIST N.A. TO DECK, FT	17.44	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN2	11687.	SEC MOD TO DECK, FT-IN2	11100.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	3	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		11

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	869.6	20.69
110	SHELL+SUPPORT	419.7	15.38
120	HULL STRUCTURAL BHD	87.3	20.30
130	HULL DECKS	272.6	30.90
140	HULL PLATFORM/FLATS	90.0	14.90

HULL STRUCT MODULE 1.500 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - APPENDAGE MODULE - 5/31/96 08.35.12.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 104.6

SHELL DISP, LTON 15.3

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	12.7	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8824	AVG RUDDER CHORD, FT	6.17
SKEG THK, FT	1.00	RUDDER THK, FT	0.83
SKEG PROJECTED AREA, FT2	445.7	RUDDER SPAN, FT	20.46
		RUDDER PROJECTED AREA, FT2	126.2
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	3.4
BILGE KEEL DISP, LTON	6.1		

BILGE KEEL LGTH, FT	92.14	FIN SIZE IND	CALC
		NO FIN PAIRS	1
SHAFT SUPPORT TYPE IND	POD	FWD FIN	
SHAFT SUPPORT DISP, LTON	60.3	CHORD, FT	10.01
SHAFT DISP, LTON	0.0	THK, FT	1.50
		SPAN, FT	10.01
PROP TYPE IND	FP	PROJECTED AREA, FT2	100.1
PROP BLADE DISP, LTON	1.0	DISP, LTON (PER PAIR)	5.7
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	13.55	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.375 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.35.14.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	4216.1	CORR ALW	0.00050
AVG ENDUR DISP, LTON	4013.0	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	469.2	TRAILSHAFT PWR FAC	1.15
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.226
NO PROP SHAFTS	2.	SUSTN SPEED	0.252
PROP DIA, FT	13.55	ENDUR SPEED	0.488

CONDITION	SPEED	EFFECTIVE HORSEPOWER, HP						DRAG
	KT	FRIC	RESID	APPDG	WIND	MARGIN	TOTAL	LBF
MAX	26.08	6048.	7904.	4103.	253.	1465.	19772.	247016.
SUSTN	25.00	5345.	5675.	3582.	223.	1186.	16011.	208692.
ENDUR	14.00	970.	429.	813.	40.	180.	2431.	56594.
RESISTANCE MODULE			1.000 CPU SECONDS.					

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.35.15.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	ANY
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL

MAX SPEED, KT	26.08	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	9886.	ENDUR EHP (/SHAFT), HP	1216.
MAX SHP (/SHAFT), HP	13373.	ENDUR SHP (/SHAFT), HP	1602.
MAX PROP RPM	170.0	ENDUR PROP RPM	86.8
MAX PROP EFF	0.739	ENDUR PROP EFF	0.759

SUSTN SPEED, KT	25.00	PROP DIA, FT	13.55
SUSTN EHP (/SHAFT), HP	8005.	NO BLADES	5.
SUSTN SHP (/SHAFT), HP	10714.	PITCH RATIO	1.38
SUSTN PROP RPM	159.9	EXPAND AREA RATIO	0.711
SUSTN PROP EFF	0.747	CAVITATION NO	1.73

NO PROP SHAFTS 2.0

TOTAL PROPELLER WT, LTON 18.99

PROPELLER MODULE 0.875 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.35.16.

# PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	26.08
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2763.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1169.	USABLE FUEL WT, LTON	469.2
SWBS 200 GROUP WT, LTON	530.0	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	140.8		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	1813. KW	1	0	0
VSCF SS CYCLO	3058. KW	2	2	1

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	OTHER		MTU-12V538
ENG TYPE IND	D DIESEL		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	2	0	1
ENG PWR AVAIL, HP	15396.		2529.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.306		.342
ENG LOAD FRAC	1.090		1.000
MACHINERY MODULE	2.250 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.35.18.

PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	390.0	TOTAL ACCOM	122.0
BEAM, FT	51.4	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	44564.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	560701.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	469.2	WATER HTR TYPE IND	INSTANT
FULL LOAD WT, LTON	4216.1	ANCHOR LOC IND	WEATHER DK
MAX SHP, HP	30792.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 1812.6 KW

PD GEN: VSCF @ 6115.9 KW

TOTAL AIRCOND LOAD, TON	166.4	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT, LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT, LTON	0.3

BOAT SELECT IND GIVEN  
BOAT TYPE IND MIXED  
BOAT COMPLEMENT 2 RIB+UB/UB  
SWBS 583 WT, LTON 35.6

NO FAS STATIONS 2.  
RAS STATIONS: NO TYPE  
2. BULKHEAD

SSCS 3.53 AREA, FT2 212.9  
SWBS 571 WT, LTON 10.7  
STRIKE GEAR: NO TYPE  
2. PALLET

STRK DECK AREA, FT2 430.2 STOWAGE AREA, FT2 1460.9  
SWBS 572 WT, LTON 36.6 SWBS 671 WT, LTON 2.1  
SWBS 672 WT, LTON 13.3

AUXILIARY SYS MODULE 1.625 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.35.20.

PRINTED REPORT NO. 1 - SUMMARY

SWBS	GROUP	WEIGHT		LCG	VCG	RESULTANT ADJ	
=====	=====	LTON	PER CENT	FT	FT	WT-LTON	VCG-FT
=====	=====	=====	=====	=====	=====	=====	=====
100	HULL STRUCTURE	1427.9	33.9	193.51	21.99	1.0	.00
200	PROP PLANT	530.0	12.6	249.26	8.75		
300	ELECT PLANT	140.8	3.3	347.74	24.50		
400	COMM + SURVEIL	135.3	3.2	148.20	27.63	82.6	.51
500	AUX SYSTEMS	588.7	14.0	214.50	23.22	20.0	.19
600	OUTFIT + FURN	329.6	7.8	195.00	22.43		
700	ARMAMENT	20.7	0.5	175.50	37.45	16.2	.15
M11	D+B WT MARGIN	396.5	9.4	211.67	20.51		
					-----		
	D+B KG MARGIN			+	2.56		
					=====		
	L I G H T S H I P	3569.5	84.7	211.67	23.07	119.8	.86
					=====		

F00	FULL LOADS	646.6	15.3	141.12	4.70	85.0	.21
F10	CREW + EFFECTS	13.0		183.30	25.92		
F20	MISS REL EXPEN	21.2		171.60	12.19		
F30	SHIPS STORES	17.4		210.60	19.44		
F40	FUELS + LUBRIC	576.9		135.49	3.50		
F50	FRESH WATER	18.1			4.89		
F60	CARGO						
M24	FUTURE GROWTH						

FULL LOAD WT	4216.1	100.0	200.85	20.25	204.8	1.07
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WEIGHT MODULE 1.625 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.35.21.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	4216.1	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	11.24	AC MARGIN FAC	0.200
MR VOLUME, FT3	38787.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
DKHS ONLY	1591.0	5026.5	8934.0	90598.
HULL OR DKHS	2670.0	39445.6	35630.2	470103.
TOTAL	4261.0	44472.2	44564.2	560701.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
	1. MISSION SUPPORT	5646.1	2215.5	12.7
	2. HUMAN SUPPORT	7923.7	381.5	17.8
	3. SHIP SUPPORT	12182.4	1346.5	27.4
	4. SHIP MOBILITY SYSTEM	16602.2	843.7	37.3
	5. UNASSIGNED	2117.7	239.4	4.8
	TOTAL	44472.2	5026.5	100.0

SPACE MODULE 1.500 CPU SECONDS.



PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE  
PHOSPHORIC ACIC  
12 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP			390.0	GROUP 1 - HULL STRUCTURE	1427.9
LOA			408.8	GROUP 2 - PROP PLANT	530.0
BEAM, DWL			51.4	GROUP 3 - ELECT PLANT	140.8
BEAM, WEATHER DECK			55.8	GROUP 4 - COMM + SURVEIL	135.3
DEPTH @ STA 10			34.0	GROUP 5 - AUX SYSTEMS	588.7
DRAFT TO KEEL DWL			15.8	GROUP 6 - OUTFIT + FURN	329.6
DRAFT TO KEEL LWL			15.8	GROUP 7 - ARMAMENT	20.7
FREEBOARD @ STA 3			22.7	-----	
GMT			5.1	SUM GROUPS 1-7	3173.0
CP			0.570	DESIGN MARGIN	396.5
CX			0.795	-----	
SPEED(KT): MAX= 26.1 SUST= 25.0				LIGHTSHIP WEIGHT	3569.5
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	646.6
TRANSMISSION TYPE: ELECT				-----	
MAIN ENG: 2 D DIESEL @ 15396.0 HP				FULL LOAD DISPLACEMENT	4216.1
SHAFT POWER/SHAFT: 13372.5 HP				FULL LOAD KG: FT	20.3
PROPELLERS: 2 - FP - 13.5 FT DIA				-----	
SEP GEN: 1 F DIESEL @ 1812.6 KW				MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 3057.9 KW				USABLE FUEL WT - LTON	469.2
24 HR LOAD			1168.8	AREA SUMMARY - FT2	
MAX MARG ELECT LOAD			2762.8	HULL AREA	35630.2
				SUPERSTRUCTURE AREA	8934.0
				-----	
				TOTAL AREA	44564.2
				VOLUME SUMMARY - FT3	
				HULL VOLUME	470102.9
				SUPERSTRUCTURE VOLUME	90598.3
				-----	
				TOTAL VOLUME	560701.2

PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
-----					
TOTAL	99.	11.	0.	110.	122.

PRINTED REPORT NO. 3 - INDICATORS

MISSION

DESIGN MODE IND-ENDURANCE  
ENDUR DISP IND -AVG DISP  
ENDUR DEF IND -USN  
SUSTN SPEED IND-GIVEN  
ENDUR SPEED IND-GIVEN

HULL FORM FACTORS

HULL OFFSETS IND-GENERATE  
HULL DIM IND -B+T

HULL BOUNDARY CONDITIONS

HULL BC IND -CONV DD  
HULL STA IND -GIVEN

SHELL APPENDAGES

BILGE KEEL IND -PRESENT  
SKEG IND -PRESENT

MARGIN LINE

MARGIN LINE IND-CALC

HULL SUBDIVISION FACTORS

HULL SUBDIV IND-GIVEN

INNER BOTTOM

INNER BOTTOM IND-PRESENT

HULL LOADS

HULL LOADS IND -CALC  
SHOCK FNDTN IND-SHOCK

STRUCTURAL ARRANGEMENT

BOT PLATE LIMIT IND-CALC

STIFFENERS

STIFFENER SHAPE IND-CALC

DKHS GEOM FACTORS

DKHS GEOM IND -GENERATE  
DKHS SIZE IND -AUTO X

DKHS MATERIALS

DKHS MTRL TYPE IND-HTS  
FIRE PROTECT IND -NONE

DKHS LOADS

BLAST RESIST IND-7 PSI

ARRANGEMENT TYPES

MECH CL ARR IND -  
MECH PORT ARR IND -  
MECH STBD ARR IND -  
ELECT PG ARR 1 IND-M-PG  
ELECT PG ARR 2 IND-  
ELECT DL ARR IND -MTR

ARRANGEMENT CG

MACHY KG IND -GIVEN

ENGINE CONFIG FACTORS

ENG ENDUR RPM IND -CALC  
SEC ENG USAGE IND -  
ENDUR CONFIG IND -NO TS  
GT ENG ENCL IND -NONE  
DIESEL ENG MOUNT IND-NONE

GEARS

SEC ENG 2 SPD GEAR IND-  
GEAR IMPED MASS IND -NONE

PROPULSION SHAFTING

SHAFT SUPPORT TYPE IND-POD  
SHAFT SYS SIZE IND -CALC

PROPULSION SHAFT BEARING

THRUST BRG LOC IND-CALC

PROPELLER FACTORS

PROP TYPE IND -FP  
PROP SERIES IND-ANALYTIC  
PROP DIA IND -CALC  
PROP AREA IND -CALC  
PROP LOC IND -CALC  
PITCH RATIO IND-CALC

OPEN WATER PROP DATA

PROP ID IND -ANY

PROPULSION SUPPORT SYS

INLET TYPE IND -PLENUM  
DUCT SILENCING IND -BOTH  
EXHAUST IR SUPP IND-NONE

SS GENERATOR FACTORS

SS SYS TYPE IND-PD  
FREQ CONV IND -NEW

SS GENERATOR SIZE

SS GEN SIZE IND-NON STD

SS ENGINES

SS ENG SELECT IND -GIVEN  
SS ENG MODEL IND -MTU-12V538  
SS ENG TYPE IND -F DIESEL  
SS ENG SFC EQN IND-DIESEL  
SS ENG SIZE IND -CALC

SONAR SYSTEM

SONAR DOME IND -NONE  
SONAR DRAG IND -

CLIMATE CONTROL

COLL PROTECT SYS IND-PRESENT  
REFER MACHY LOC IND -INSIDE  
AUX BOILER TYPE IND -ELECTRIC

SEA WATER SYSTEMS

AIR AND MISC FLUID SYSTEM

RUDDERS

RUDDER SIZE IND-CALC  
RUDDER TYPE IND-INTEGRAL

ROLL FINS

FIN SIZE IND -CALC

REPLENISHMENT SYSTEMS

# MAIN ENGINES

MAIN ENG SELECT IND-GIVEN  
 MAIN ENG MOD IND -OTHER  
 MAIN ENG TYPE IND -D DIESEL  
 MAIN ENG SFC EQ IND-DIESEL  
 MAIN ENG SIZE IND -GIVEN

SPECIAL PURPOSE SYSTEMS  
 POLLUTION CNTL IND-PRESENT  
 OUTFIT AND FURNISHINGS  
 UNIT CMDR IND -NONE

# SEC ENGINES

SEC ENG SELECT IND -  
 SEC ENG MODEL IND -  
 SEC ENG TYPE IND -  
 SEC ENG SFC EQN IND-  
 SEC ENG SIZE IND -

FUELS AND LUBRICANTS  
 SHIP FUEL TYPE IND-DFM  
 RESISTANCE FACTORS  
 FRICTION LINE IND -ITTC  
 RESID RESIST IND -NRC  
 WORM CURVE IND -DD CALC  
 PRPLN SYS RESIST IND-CALC  
 SHIP WEIGHT  
 SHIP LCG INPUT IND-CALC

# TRANSMISSION FACTORS

TRANS TYPE IND -ELECT  
 TRANS EFF IND -CALC

# ELECTRICAL TRANSMISSION

ELECT PRPLN TYPE IND -ACR-DCS  
 ELECT PRPLN RATIND IND-GIVEN  
 AC SYNC ROTOR COOL IND-AIR  
 TRANS LINE NODE PT IND-CALC  
 SWITCHGEAR TYPE IND -ADV

# PRINTED REPORT NO. 4 - MARGINS

# HULL

MIN FREEBOARD MARGIN, FT .25  
 HULL MARGIN STRESS, KSI 2.24

# PROPULSION PLANT

TORQUE MARGIN FAC 1.200

# ELECTRIC PLANT

ELECT LOAD DES MARGIN FAC .200  
 ELECT LOAD SL MARGIN FAC .100

# AUXILIARY SYSTEMS

AC MARGIN FAC .200

# OUTFIT AND FURNISHINGS

CREW ACCOM MARGIN FAC .100

# WEIGHT MARGINS

GROWTH WT MARGIN, LTON .0  
 D+B WT MARGIN, LTON .0  
 D+B WT MARGIN FAC .125  
 D+B KG MARGIN, FT .00  
 D+B KG MARGIN FAC .125

# RESISTANCE FACTORS

DRAG MARGIN FAC .080

# SPACE FACTORS

SPACE MARGIN FAC .050  
 PASSWAY MARGIN FAC .000  
 TANKAGE MARGIN FAC .000

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW PAYLOAD AND ADJUSTMENT NAME

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=====
1  CIC COMMAND AND DECISION MODFIG
2  EXCOMM (1/2 DDG51)
3  NAV SYS (1/2 DDG 51)
4  SPS-67 SSR
5  SPY-3C (MINI-SPY)
6  MK XII AIMS IFF
7  LUBE OIL SYS REDUCTION
8  SLQ-25 NIXIE
9  SLQ-32(V)3 ACTIVE/PASSIVE ECM
10 DESULFERIZER
11 CS HOLD UP BATTERY
12 SENSOR COOLING SYSTEMS
13 HELO HANGAR
14 CRANE
15 BALLAST
16 OPER READINESS AND TEST SYS
17 RAST/TALON HELO COMBO
18 RAST CONTROL STATION
19 LAMPS MKIV: AVIATION SUPPORT & SPARES
20 VSCF GENS AND CYCLO REDUCTION
21 1X 40MM CIWS/MULTI PURP GUN
22 1X 40MM CIWS/MULTI PURP GUN
23 21 CELL RAM LAUNCHER
24 LONGITUDNAL BULKHEADS AROUND MAGAZINE
26 40MM AMMO (MIXED) 3000 RNDS
27 40MM AMMO (MIXED) -- 3000 RNDS
29 HELO AS565 PANTHER: (DOLPHIN)
30 LAMPS MKIII: FUEL [JP-5]
32 ADMIN LAN
34 AVIATION STORES
36 MINE DETECTION HULL MOUNTED SONAR

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ROW	WT KEY	WT ADD LTON	WT FAC	VCG KEY	VCG ADD FT	VCG FAC
===	====	=====	=====	=====	=====	=====
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
7	W262	-22.73	.000	BL	10.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
10	W261	4.30	.000	BL	10.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W588	10.00	.000	BL	40.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000

15	W191	1.00	.000	BL	1.00	1.000
16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
20	W311	-20.50	.000	BL	7.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000
22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000

ROW	AREA KEY	---AREA ADD, FT2---		-----AREA FAC-----	
		HULL/SS	SS/ONLY	HULL/SS	SS/ONLY
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
7	NONE	.00	-100.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
10	NONE	.00	93.50	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	A1312	.00	600.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
20	NONE	-250.00	.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

ROW	KW	-----KW ADD, KW-----			-----KW FAC-----		
	KEY	W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
7	NONE	-5.00	-10.00	-5.00	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
10	NONE	5.00	10.00	5.00	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000
13	NONE	5.00	10.00	5.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000
17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	.00	.00	.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000



## APPENDIX K. 13.2 MEGAWATT PAFC MODEL SUMMARY

This appendix contains the summary reports of each module for the 110% power PAFC model. It also contains the indicator listing and entire design summary.

ASSET/MONOSC VERSION 3.3+ - HULL GEOM MODULE - 5/31/96 08.35.50.

### PRINTED REPORT NO. 1 - HULL GEOMETRY SUMMARY

HULL OFFSETS IND-GENERATE	MIN BEAM, FT	36.00
HULL DIM IND-B+T	MAX BEAM, FT	57.00
MARGIN LINE IND-CALC	HULL FLARE ANGLE, DEG	7.00
HULL STA IND-GIVEN	FORWARD BULWARK, FT	0.00
HULL BC IND-CONV DD		

### HULL PRINCIPAL DIMENSIONS (ON DWL)

LBP, FT	392.00	PRISMATIC COEF	0.570
LOA, FT	410.87	MAX SECTION COEF	0.795
BEAM, FT	51.38	WATERPLANE COEF	0.730
BEAM @ WEATHER DECK, FT	55.78	LCB/LCP	0.515
DRAFT, FT	16.12	HALF SIDING WIDTH, FT	1.00
DEPTH STA 0, FT	41.78	BOT RAKE, FT	0.00
DEPTH STA 3, FT	38.53	RAISED DECK HT, FT	0.00
DEPTH STA 10, FT	34.00	RAISED DECK FWD LIM, STA	
DEPTH STA 20, FT	34.78	RAISED DECK AFT LIM, STA	
FREEBOARD @ STA 3, FT	22.41	BARE HULL DISPL, LTON	4205.28
STABILITY BEAM, FT	51.38	AREA BEAM, FT	48.51

### BARE HULL DATA ON LWL

LGTH ON WL, FT	392.00
BEAM, FT	51.38
DRAFT, FT	16.11
FREEBOARD @ STA 3, FT	22.41
PRISMATIC COEF	0.570
MAX SECTION COEF	0.796
WATERPLANE COEF	0.734
WATERPLANE AREA, FT2	14788.19
WETTED SURFACE, FT2	20053.01
BARE HULL DISPL, LTON	4207.69
APPENDAGE DISPL, LTON	105.62
FULL LOAD WT, LTON	4313.30
HULL GEOM MODULE	1.875 CPU SECONDS.

### STABILITY DATA ON LWL

KB, FT	9.90
BMT, FT	16.00
KG, FT	20.16
FREE SURF COR, FT	0.10
SERV LIFE KG ALW, FT	0.50
GMT, FT	5.14
GML, FT	843.27
GMT/B AVAIL	0.100
GMT/B REQ	0.100



ASSET/MONOSC VERSION 3.3+ - HULL SUBDIV MODULE - 5/31/96 08.35.52.

PRINTED REPORT NO. 1 - SUMMARY

HULL SUBDIV IND-GIVEN

INNER BOT IND-PRESENT

SHAFT SUPPORT TYPE IND-POD

LBP, FT	392.00	HULL AVG DECK HT, FT	11.02
DEPTH STA 10, FT	34.00		
		NO INTERNAL DECKS	2
HULL VOLUME, FT3	470240.	NO TRANS BHDS	11
MR VOLUME, FT3	46609.	NO LONG BHDS	0
TANKAGE VOL REQ, FT3	25246.	NO MACHY RMS	3
EXCESS TANKAGE, FT3	13250.	NO PROP SHAFTS	2
ARR AREA LOST TANKS, FT2	24.3		
HULL ARR AREA AVAIL, FT2	35551.2		
HULL SUBDIV MODULE	0.750 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - DECKHOUSE MODULE - 5/31/96 08.35.52.

PRINTED REPORT NO. 1 - DECKHOUSE SUMMARY

DKHS GEOM IND-GENERATE

BLAST RESIST IND-7 PSI

DKHS SIZE IND-AUTO X

FIRE PROTECT IND-NONE

DKHS MTRL TYPE IND-HTS

LBP, FT	392.00	DKHS LENGTH OA, FT	160.73
BEAM, FT	51.38	DKHS MAX WIDTH, FT	56.10
AREA BEAM, FT	48.51	DKHS HT (W/O PLTHS), FT	46.76
DKHS FWD LIMIT-	STA 4.0	OTHER ARR AREA REQ, FT2	39446.46
DKHS AFT LIMIT-	STA 12.2	HULL ARR AREA AVAIL, FT2	35551.21
DKHS AVG DECK HT, FT	9.84	DKHS ARR AREA REQ, FT2	5040.30
DKHS NO LVLS	2	HANGER ARR AREA REQ, FT2	0.00
DKHS AVG SIDE CLR, FT	.00	PLTHS ARR AREA REQ, FT2	614.14
DKHS AVG SIDE ANG, DEG	10.00		
DKHS NO PRISMS	20	DKHS MAX ARR AREA, FT2	11475.56
DKHS ARR AREA DERIV, FT2	191.97	DKHS ARR AREA AVAIL, FT2	9027.58
DKHS MIN ALW BEAM, FT	20.50	DKHS VOLUME, FT3	91553.91
BRIDGE L-O-S OVER BOW, FT	296.02		
		DKHS WEIGHT, LTON	175.97
DKHS SIDE CLR OFFSET, FT		DKHS VCG, FT	40.83
DKHS SIDE ANG OFFSET, DEG			
DKHS DECK HT OFFSET, FT			
DECKHOUSE MODULE	1.125 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - HULL STRUCT MODULE - 5/31/96 08.35.54.

PRINTED REPORT NO. 1 - SUMMARY

INNER BOT IND-PRESENT  
STIFFENER SHAPE IND-CALC

HULL LOADS IND-CALC

----- HULL STRENGTH AND STRESS -----			
HOGGING BM, FT-LTON	71443.	PRIM STRESS KEEL-HOG, KSI	13.83
SAGGING BM, FT-LTON	59562.	PRIM STRESS KEEL-SAG, KSI	11.53
MIDSHIP MOI, FT2-IN2	193265.	PRIM STRESS DECK-HOG, KSI	14.33
DIST N.A. TO KEEL, FT	16.70	PRIM STRESS DECK-SAG, KSI	11.95
DIST N.A. TO DECK, FT	17.31	HULL MARGIN STRESS, KSI	2.24
SEC MOD TO KEEL, FT-IN2	11572.	SEC MOD TO DECK, FT-IN2	11167.

HULL STRUCTURE COMPONENTS

	MATERIAL TYPE	NO OF SEGMENT	NO
WET. DECK	HTS	4	1
SIDE SHELL	HTS	3	1
BOTTOM SHELL	HTS	6	1
INNER BOTTOM	HTS	5	1
INT. DECK	HTS	4	2
STRINGER, SHEER	HTS	1	1
LONG BULKHEAD			0
TRANS BULKHEAD	HTS		11

HULL STRUCTURE WEIGHT

SWBS	COMPONENT	WEIGHT, LTON	VCG, FT
100	HULL STRUCTURE	874.5	20.81
110	SHELL+SUPPORT	425.3	15.47
120	HULL STRUCTURAL BHD	87.6	20.31
130	HULL DECKS	272.8	31.09
140	HULL PLATFORM/FLATS	88.9	15.33

HULL STRUCT MODULE 1.625 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - APPENDAGE MODULE - 5/31/96 08.35.55.

PRINTED REPORT NO. 1 - SUMMARY

APPENDAGE DISP, LTON 105.6

SHELL DISP, LTON 15.4

SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
SKEG DISP, LTON	13.1	NO RUDDERS	2
SKEG AFT LIMIT/LBP	0.8827	AVG RUDDER CHORD, FT	6.29
SKEG THK, FT	1.00	RUDDER THK, FT	0.85
SKEG PROJECTED AREA, FT2	457.2	RUDDER SPAN, FT	20.53
		RUDDER PROJECTED AREA, FT2	129.1
BILGE KEEL IND	PRESENT	RUDDER DISP, LTON	3.6
BILGE KEEL DISP, LTON	6.1		
BILGE KEEL LGTH, FT	92.61	FIN SIZE IND	CALC

SHAFT SUPPORT TYPE IND	POD	NO FIN PAIRS	1
SHAFT SUPPORT DISP, LTON	60.4	FWD FIN	
SHAFT DISP, LTON	0.0	CHORD, FT	10.13
		THK, FT	1.52
		SPAN, FT	10.13
PROP TYPE IND	FP	PROJECTED AREA, FT2	102.7
PROP BLADE DISP, LTON	1.0	DISP, LTON (PER PAIR)	6.0
NO PROP SHAFTS	2	AFT FIN	
PROP DIA, FT	13.58	CHORD, FT	
		THK, FT	
SONAR DOME IND	NONE	SPAN, FT	
SONAR DISP, LTON	0.0	PROJECTED AREA, FT2	
		DISP, LTON (PER PAIR)	
APPENDAGE MODULE	1.375 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - RESISTANCE MODULE - 5/31/96 08.35.56.

PRINTED REPORT NO. 1 - SUMMARY

RESID RESIST IND	NRC	BILGE KEEL IND	PRESENT
FRICTION LINE IND	ITTC	SHAFT SUPPORT TYPE IND	POD
ENDUR DISP IND	AVG DISP	PRPLN SYS RESIST IND	CALC
ENDUR CONFIG IND	NO TS	PROP TYPE IND	FP
SONAR DRAG IND		SONAR DOME IND	NONE
SKEG IND	PRESENT	RUDDER TYPE IND	INTEGRAL
FULL LOAD WT, LTON	4313.3	CORR ALW	0.00050
AVG ENDUR DISP, LTON	4108.1	DRAG MARGIN FAC	0.080
USABLE FUEL WT, LTON	474.2	TRAILSHAFT PWR FAC	1.15
NO RUDDERS	2.		
NO FIN PAIRS	1.	PRPLN SYS RESIST FRAC	
PROP TIP CLEAR RATIO	0.25	MAX SPEED	0.222
NO PROP SHAFTS	2.	SUSTN SPEED	0.248
PROP DIA, FT	13.58	ENDUR SPEED	0.479

CONDITION	SPEED-----KT	FRIC	RESID	APPDGD	WIND	MARGIN	TOTAL	DRAG LBF
MAX	26.08	6114.	7996.	4105.	249.	1477.	19941.	249156.
SUSTN	25.00	5406.	5744.	3583.	219.	1196.	16148.	210489.
ENDUR	14.00	981.	437.	812.	39.	182.	2451.	57047.
RESISTANCE MODULE			1.125 CPU SECONDS.					

ASSET/MONOSC VERSION 3.3+ - PROPELLER MODULE - 5/31/96 08.35.57.

PRINTED REPORT NO. 1 - SUMMARY

ENDUR CONFIG IND	NO TS		
PROP TYPE IND	FP	PROP SERIES IND	ANALYTIC
PROP DIA IND	CALC	PROP LOC IND	CALC
PROP AREA IND	CALC	PROP ID IND	ANY
SHAFT SUPPORT TYPE IND	POD	RUDDER TYPE IND	INTEGRAL
MAX SPEED, KT	26.08	ENDUR SPEED, KT	14.00
MAX EHP (/SHAFT), HP	9971.	ENDUR EHP (/SHAFT), HP	1225.

MAX SHP (/SHAFT), HP	13495.	ENDUR SHP (/SHAFT), HP	1615.
MAX PROP RPM	170.0	ENDUR PROP RPM	86.8
MAX PROP EFF	0.739	ENDUR PROP EFF	0.759

SUSTN SPEED, KT	25.00	PROP DIA, FT	13.58
SUSTN EHP (/SHAFT), HP	8074.	NO BLADES	5.
SUSTN SHP (/SHAFT), HP	10811.	PITCH RATIO	1.38
SUSTN PROP RPM	159.9	EXPAND AREA RATIO	0.711
SUSTN PROP EFF	0.747	CAVITATION NO	1.73

NO PROP SHAFTS 2.0

TOTAL PROPELLER WT, LTON 19.15  
PROPELLER MODULE 0.875 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - MACHINERY MODULE - 5/31/96 08.35.59.

PRINTED REPORT NO. 1 - SUMMARY

TRANS TYPE IND	ELECT	MAX SPEED, KT	26.08
ELECT PRPLN TYPE IND	ACR-DCS	SUSTN SPEED IND	GIVEN
SHAFT SUPPORT TYPE IND	POD	SUSTN SPEED, KT	25.00
NO PROP SHAFTS	2.	ENDUR SPEED IND	GIVEN
ENDUR CONFIG IND	NO TS	ENDUR SPEED, KT	14.00
SEC ENG USAGE IND		DESIGN MODE IND	ENDURANCE
MAX MARG ELECT LOAD, KW	2753.	ENDURANCE, NM	8000.
AVG 24 HR ELECT LOAD, KW	1165.	USABLE FUEL WT, LTON	474.2
SWBS 200 GROUP WT, LTON	576.6	SUSTN SPEED POWER FRAC	0.80
SWBS 300 GROUP WT, LTON	140.3		

ARRANGEMENT OR SS GEN	TYPE	NO INSTALLED	NO ONLINE MAX+SUSTN	NO ONLINE ENDURANCE
ELECT PG ARR 1 IND	M-PG	2	2	1
ELECT PG ARR 2 IND		0	0	0
ELECT DL ARR IND	MTR	2	2	2
SEP SS GEN	1807. KW	1	0	0
VSCF SS CYCLO	3040. KW	2	2	1

	MAIN ENG	SEC ENG	SS ENG
ENG SELECT IND	GIVEN		GIVEN
ENG MODEL IND	OTHER		MTU-12V538
ENG TYPE IND	D DIESEL		F DIESEL
ENG SIZE IND	GIVEN		CALC
NO INSTALLED	2	0	1
ENG PWR AVAIL, HP	16936.		2521.
ENG RPM	3600.0		1800.0
ENG SFC, LBM/HP-HR	0.306		.342
ENG LOAD FRAC	0.999		1.000
MACHINERY MODULE	2.375 CPU SECONDS.		

ASSET/MONOSC VERSION 3.3+ - AUXILIARY SYS MODULE - 5/31/96 08.36.01.

PRINTED REPORT NO. 1 - SUMMARY

LBP, FT	392.0	TOTAL ACCOM	122.0
BEAM, FT	51.4	COLL PROT SYS IND	PRESENT
TOTAL AREA, FT2	44579.	COMP HTR TYPE IND	ELECTRIC
TOTAL VOLUME, FT3	561794.	DISTILLER TYPE IND	RE OSMOSIS
USABLE FUEL WT, LTON	474.2	WATER HTR TYPE IND	INSTANT
FULL LOAD WT, LTON	4313.3	ANCHOR LOC IND	WEATHER DK
MAX SHP, HP	33871.	PRAIRIE SYS IND	PRESENT
		MASKER SYS IND	PRESENT

SEP GEN: 1806.7 KW

PD GEN: VSCF @ 6079.5 KW

TOTAL AIRCOND LOAD, TON	166.4	TOTAL STEAM LOAD, LB/HR	110.
NO AIRCOND UNITS	3.0	AUX BOILER TYPE IND	ELECTRIC
TOTAL AIRCOND CAP, TON	255.0	NO AUX BOILERS	2.
SWBS 514 WT, LTON	55.7	TOTAL AUX BLR CAP, LB/HR	200.
		SWBS 517 WT, LTON	0.3

BOAT SELECT IND	GIVEN		
BOAT TYPE IND	MIXED		
BOAT COMPLEMENT	2 RIB+UB/UB	NO FAS STATIONS	2.
SWBS 583 WT, LTON	35.6	RAS STATIONS:	NO TYPE
			2. BULKHEAD

STRIKE GEAR:	NO	TYPE	SSCS 3.53 AREA, FT2	212.9
	2.	PALLET	SWBS 571 WT, LTON	10.7

STRK DECK AREA, FT2	430.3	STOWAGE AREA, FT2	1461.6
SWBS 572 WT, LTON	36.1	SWBS 671 WT, LTON	2.1
		SWBS 672 WT, LTON	13.3

AUXILIARY SYS MODULE 1.625 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - WEIGHT MODULE - 5/31/96 08.36.03.

PRINTED REPORT NO. 1 - SUMMARY

SWBS	G R O U P	W E I G H T		LCG FT	VCG FT	RESULTANT ADJ	
		LTON	PER CENT			WT-LTON	VCG-FT
100	HULL STRUCTURE	1453.9	33.7	194.11	21.92	1.0	.00
200	PROP PLANT	576.6	13.4	244.86	9.08		
300	ELECT PLANT	140.3	3.3	350.35	24.73		
400	COMM + SURVEIL	135.4	3.1	148.96	27.63	82.6	.50
500	AUX SYSTEMS	594.6	13.8	215.60	23.15	20.0	.19
600	OUTFIT + FURN	331.5	7.7	196.00	22.43		
700	ARMAMENT	20.7	0.5	176.40	37.45	16.2	.15
M11	D+B WT MARGIN	406.5	9.4	211.97	20.38		
	D+B KG MARGIN			+	2.55		
=====							
L I G H T S H I P		3659.6	84.8	211.97	22.93	119.8	.84
=====							

F00	FULL LOADS	653.7	15.2	145.38	4.67	85.0	.21
F10	CREW + EFFECTS	13.0		184.24	25.93		
F20	MISS REL EXPEN	21.2		172.48	12.19		
F30	SHIPS STORES	17.4		211.68	19.45		
F40	FUELS + LUBRIC	584.0		140.21	3.48		
F50	FRESH WATER	18.1			4.89		
F60	CARGO						
M24	FUTURE GROWTH						

FULL LOAD WT	4313.3	100.0	201.88	20.16	204.8	1.05
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WEIGHT MODULE 1.500 CPU SECONDS.

ASSET/MONOSC VERSION 3.3+ - SPACE MODULE - 5/31/96 08.36.04.

PRINTED REPORT NO. 1 - SUMMARY

COLL PROTECT SYSTEM-PRESENT  
SONAR DOME-NONE

HAB STANDARD-NAVY  
UNIT COMMANDER-NONE

FULL LOAD WT, LTON	4313.3	HAB STANDARD FAC	0.000
TOTAL CREW ACC	122.	PASSWAY MARGIN FAC	0.000
HULL AVG DECK HT, FT	11.02	AC MARGIN FAC	0.200
MR VOLUME, FT3	46609.	SPACE MARGIN FAC	0.050

	PAYLOAD REQUIRED	AREA FT2 TOTAL REQUIRED	TOTAL AVAILABLE	VOL FT3 TOTAL ACTUAL
DKHS ONLY	1591.0	5040.2	9027.6	91554.
HULL OR DKHS	2670.0	39446.4	35551.2	470240.
TOTAL	4261.0	44486.6	44578.8	561794.

SSCS	GROUP	TOTAL AREA FT2	DKHS AREA FT2	PERCENT TOTAL AREA
1.	MISSION SUPPORT	5647.9	2215.8	12.7
2.	HUMAN SUPPORT	7923.7	381.5	17.8
3.	SHIP SUPPORT	12203.6	1357.7	27.4
4.	SHIP MOBILITY SYSTEM	16593.0	845.2	37.3
5.	UNASSIGNED	2118.4	240.0	4.8

TOTAL	44486.6	5040.2	100.0
SPACE MODULE	1.375 CPU SECONDS.		

PRINTED REPORT NO. 1 - SUMMARY

SHIP COMMENT TABLE  
PHOSPHORIC ACID  
13.2 MW PLANT (X2)

PRINCIPAL CHARACTERISTICS - FT				WEIGHT SUMMARY - LTON	
LBP		392.0		GROUP 1 - HULL STRUCTURE	1453.9
LOA		410.9		GROUP 2 - PROP PLANT	576.6
BEAM, DWL		51.4		GROUP 3 - ELECT PLANT	140.3
BEAM, WEATHER DECK		55.8		GROUP 4 - COMM + SURVEIL	135.4
DEPTH @ STA 10		34.0		GROUP 5 - AUX SYSTEMS	594.6
DRAFT TO KEEL DWL		16.1		GROUP 6 - OUTFIT + FURN	331.5
DRAFT TO KEEL LWL		16.1		GROUP 7 - ARMAMENT	20.7
FREEBOARD @ STA 3		22.4		-----	
GMT		5.1		SUM GROUPS 1-7	3253.1
CP		0.570		DESIGN MARGIN	406.5
CX		0.795		-----	
SPEED(KT): MAX= 26.1 SUST= 25.0				LIGHTSHIP WEIGHT	3659.6
ENDURANCE: 8000.0 NM AT 14.0 KTS				LOADS	653.7
TRANSMISSION TYPE: ELECT				-----	
MAIN ENG: 2 D DIESEL @ 16935.5 HP				FULL LOAD DISPLACEMENT	4313.3
SHAFT POWER/SHAFT: 13494.6 HP				FULL LOAD KG: FT	20.2
PROPELLERS: 2 - FP - 13.6 FT DIA				-----	
SEP GEN: 1 F DIESEL @ 1806.7 KW				MILITARY PAYLOAD WT - LTON	201.5
PD GEN: 2 VSCF @ 3039.7 KW				USABLE FUEL WT - LTON	474.2
24 HR LOAD				-----	
MAX MARG ELECT LOAD				AREA SUMMARY - FT2	
				HULL AREA	- 35551.2
				SUPERSTRUCTURE AREA	- 9027.6
				-----	
				TOTAL AREA	44578.8
				-----	
				VOLUME SUMMARY - FT3	
				HULL VOLUME	- 470239.7
				SUPERSTRUCTURE VOLUME	- 91553.9
				-----	
				TOTAL VOLUME	561793.6

PRINTED REPORT NO. 2 - MANNING AND ACCOMMODATION SUMMARY

CREW ACCOM MARGIN FAC 0.10

	SHIPS CREW	AIR DETACH	FLAG STAFF /OTHER	TOTAL MANNING	TOTAL ACCOMMODATION
OFFICERS	11.	4.	0.	15.	17.
CPO	12.	1.	0.	13.	15.
OEM	76.	6.	0.	82.	90.
-----					
TOTAL	99.	11.	0.	110.	122.

PRINTED REPORT NO. 3 - INDICATORS

MISSION

DESIGN MODE IND-ENDURANCE  
ENDUR DISP IND -AVG DISP  
ENDUR DEF IND -USN  
SUSTN SPEED IND-GIVEN  
ENDUR SPEED IND-GIVEN

HULL FORM FACTORS

HULL OFFSETS IND-GENERATE  
HULL DIM IND -B+T

HULL BOUNDARY CONDITIONS

HULL BC IND -CONV DD  
HULL STA IND -GIVEN

SHELL APPENDAGES

BILGE KEEL IND -PRESENT  
SKEG IND -PRESENT

MARGIN LINE

MARGIN LINE IND-CALC

HULL SUBDIVISION FACTORS

HULL SUBDIV IND-GIVEN

INNER BOTTOM

INNER BOTTOM IND-PRESENT

HULL LOADS

HULL LOADS IND -CALC  
SHOCK FNDTN IND-SHOCK

STRUCTURAL ARRANGEMENT

BOT PLATE LIMIT IND-CALC

STIFFENERS

STIFFENER SHAPE IND-CALC

DKHS GEOM FACTORS

DKHS GEOM IND -GENERATE  
DKHS SIZE IND -AUTO X

DKHS MATERIALS

DKHS MTRL TYPE IND-HTS  
FIRE PROTECT IND -NONE

DKHS LOADS

BLAST RESIST IND-7 PSI

ARRANGEMENT TYPES

MECH CL ARR IND -  
MECH PORT ARR IND -  
MECH STBD ARR IND -  
ELECT PG ARR 1 IND-M-PG  
ELECT PG ARR 2 IND-  
ELECT DL ARR IND -MTR

ARRANGEMENT CG

MACHY KG IND -GIVEN

ENGINE CONFIG FACTORS

ENG ENDUR RPM IND -CALC  
SEC ENG USAGE IND -  
ENDUR CONFIG IND -NO TS  
GT ENG ENCL IND -NONE  
DIESEL ENG MOUNT IND-NONE

GEARS

SEC ENG 2 SPD GEAR IND-  
GEAR IMPED MASS IND -NONE

PROPULSION SHAFTING

SHAFT SUPPORT TYPE IND-POD  
SHAFT SYS SIZE IND -CALC

PROPULSION SHAFT BEARING

THRUST BRG LOC IND-CALC

PROPELLER FACTORS

PROP TYPE IND -FP  
PROP SERIES IND-ANALYTIC  
PROP DIA IND -CALC  
PROP AREA IND -CALC  
PROP LOC IND -CALC  
PITCH RATIO IND-CALC

OPEN WATER PROP DATA

PROP ID IND -ANY

PROPULSION SUPPORT SYS

INLET TYPE IND -PLENUM  
DUCT SILENCING IND -BOTH  
EXHAUST IR SUPP IND-NONE

SS GENERATOR FACTORS

SS SYS TYPE IND-PD  
FREQ CONV IND -NEW

SS GENERATOR SIZE

SS GEN SIZE IND-NON STD

SS ENGINES

SS ENG SELECT IND -GIVEN  
SS ENG MODEL IND -MTU-12V538  
SS ENG TYPE IND -F DIESEL  
SS ENG SFC EQN IND-DIESEL  
SS ENG SIZE IND -CALC

SONAR SYSTEM

SONAR DOME IND -NONE  
SONAR DRAG IND -

CLIMATE CONTROL

COLL PROTECT SYS IND-PRESENT  
REFER MACHY LOC IND -INSIDE  
AUX BOILER TYPE IND -ELECTRIC

SEA WATER SYSTEMS

AIR AND MISC FLUID SYSTEM

RUDDERS

RUDDER SIZE IND-CALC  
RUDDER TYPE IND-INTEGRAL

ROLL FINS

FIN SIZE IND -CALC

REPLENISHMENT SYSTEMS



# MAIN ENGINES

MAIN ENG SELECT IND-GIVEN  
 MAIN ENG MOD IND -OTHER  
 MAIN ENG TYPE IND -D DIESEL  
 MAIN ENG SFC EQ IND-DIESEL  
 MAIN ENG SIZE IND -GIVEN

# SEC ENGINES

SEC ENG SELECT IND -  
 SEC ENG MODEL IND -  
 SEC ENG TYPE IND -  
 SEC ENG SFC EQN IND-  
 SEC ENG SIZE IND -

# TRANSMISSION FACTORS

TRANS TYPE IND -ELECT  
 TRANS EFF IND -CALC

# ELECTRICAL TRANSMISSION

ELECT PRPLN TYPE IND -ACR-DCS  
 ELECT PRPLN RATIND IND-GIVEN  
 AC SYNC ROTOR COOL IND-AIR  
 TRANS LINE NODE PT IND-CALC  
 SWITCHGEAR TYPE IND -ADV

# SPECIAL PURPOSE SYSTEMS

POLLUTION CNTL IND-PRESENT  
 OUTFIT AND FURNISHINGS  
 UNIT CMDR IND -NONE

# FUELS AND LUBRICANTS

SHIP FUEL TYPE IND-DFM

# RESISTANCE FACTORS

FRICTION LINE IND -ITTC  
 RESID RESIST IND -NRC  
 WORM CURVE IND -DD CALC  
 PRPLN SYS RESIST IND-CALC

# SHIP WEIGHT

SHIP LCG INPUT IND-CALC

# PRINTED REPORT NO. 4 - MARGINS

# HULL

MIN FREEBOARD MARGIN, FT .25  
 HULL MARGIN STRESS, KSI 2.24

# PROPULSION PLANT

TORQUE MARGIN FAC 1.200

# ELECTRIC PLANT

ELECT LOAD DES MARGIN FAC .200  
 ELECT LOAD SL MARGIN FAC .100

# AUXILIARY SYSTEMS

AC MARGIN FAC .200

# OUTFIT AND FURNISHINGS

CREW ACCOM MARGIN FAC .100

# WEIGHT MARGINS

GROWTH WT MARGIN, LTON .0  
 D+B WT MARGIN, LTON .0  
 D+B WT MARGIN FAC .125  
 D+B KG MARGIN, FT .00  
 D+B KG MARGIN FAC .125

# RESISTANCE FACTORS

DRAG MARGIN FAC .080

# SPACE FACTORS

SPACE MARGIN FAC .050  
 PASSWAY MARGIN FAC .000  
 TANKAGE MARGIN FAC .000

PRINTED REPORT NO. 5 - PAYLOAD AND ADJUSTMENTS

ROW	PAYLOAD AND ADJUSTMENT NAME
===	=====
1	CIC COMMAND AND DECISION MODFIG
2	EXCOMM (1/2 DDG51)
3	NAV SYS (1/2 DDG 51)
4	SPS-67 SSR
5	SPY-3C (MINI-SPY)
6	MK XII AIMS IFF
7	LUBE OIL SYS REDUCTION
8	SLQ-25 NIXIE
9	SLQ-32(V)3 ACTIVE/PASSIVE ECM
10	DESULFERIZER
11	CS HOLD UP BATTERY
12	SENSOR COOLING SYSTEMS
13	HELO HANGAR
14	CRANE
15	BALLAST
16	OPER READINESS AND TEST SYS
17	RAST/TALON HELO COMBO
18	RAST CONTROL STATION
19	LAMPS MKIV: AVIATION SUPPORT & SPARES
20	VSCF GENS AND CYCLO REDUCTION
21	1X 40MM CIWS/MULTI PURP GUN
22	1X 40MM CIWS/MULTI PURP GUN
23	21 CELL RAM LAUNCHER
24	LONGITUDNAL BULKHEADS AROUND MAGAZINE
26	40MM AMMO (MIXED) 3000 RNDs
27	40MM AMMO (MIXED) -- 3000 RNDs
29	HELO AS565 PANTHER: (DOLPHIN)
30	LAMPS MKIII: FUEL [JP-5]
32	ADMIN LAN
34	AVIATION STORES
36	MINE DETECTION HULL MOUNTED SONAR

ROW	WT KEY	WT ADD LTON	WT FAC	VCG KEY	VCG ADD FT	VCG FAC
===	=====	=====	=====	=====	=====	=====
1	W410	7.00	.000	D6.5	-7.22	.000
2	W440	16.00	.000	D10	-8.20	1.000
3	W420	3.80	-1.000	D10	16.00	1.000
4	W451	1.75	.000	D10	29.50	1.000
5	W456	18.00	.000	DM10	32.00	1.000
6	W455	2.30	.000	D10	30.00	1.000
7	W262	-22.73	.000	BL	10.00	1.000
8	W473	3.60	.000	D20	-8.00	1.000
9	W472	3.00	.000	D10	21.00	1.000
10	W261	4.30	.000	BL	10.00	1.000
11	W410	30.00	.000	BL	3.50	1.000
12	W532	4.00	-1.000	BL	10.00	1.000
13	W588	10.00	.000	BL	40.00	1.000
14	W500	20.00	.000	D6.5	5.00	1.000

15	W191	1.00	.000	BL	1.00	1.000
16	W491	3.00	.000	D10	2.50	1.000
17	W588	5.00	.000	D20	2.00	1.000
18	W588	.00	.000	D20	.00	.000
19	WF26	2.00	.000	D20	3.00	1.000
20	W311	-20.50	.000	BL	7.00	1.000
21	W710	6.10	.000	D6.5	3.00	1.000
22	W710	6.10	.000	D15	3.00	1.000
23	W720	4.00	.000	DM10	14.00	1.000
24	NONE	.00	.000	BL	.00	.000
26	WF21	7.40	.000	D6.5	-7.00	1.000
27	WF21	7.40	.000	D15	-7.00	.000
29	WF23	4.40	.000	D20	5.00	.000
30	WF42	63.80	.000	BL	9.84	.000
32	W491	.70	.000	BL	30.00	.000
34	NONE	2.00	.000	D20	3.00	.000
36	NONE	2.00	.000	BL	.00	.000

ROW	AREA KEY	---AREA ADD, FT2---		-----AREA FAC-----	
		HULL/SS	SS/ONLY	HULL/SS	SS/ONLY
1	A1131	400.00	.00	.000	.000
2	A1111	635.00	95.00	.000	.000
3	NONE	.00	.00	.000	.000
4	A1121	.00	70.00	.000	.000
5	A1121	100.00	400.00	.000	.000
6	A1121	.00	.00	.000	.000
7	NONE	.00	-100.00	.000	.000
8	A1142	20.00	.00	.000	.000
9	A1141	40.00	132.00	.000	.000
10	NONE	.00	93.50	.000	.000
11	NONE	250.00	.00	.000	.000
12	NONE	.00	.00	.000	.000
13	A1312	.00	600.00	.000	.000
14	A1260	900.00	.00	.000	.000
15	NONE	.00	.00	.000	.000
16	NONE	.00	.00	.000	.000
17	A1312	25.00	.00	.000	.000
18	A1312	.00	.00	.000	.000
19	A1360	.00	50.00	.000	.000
20	NONE	-250.00	.00	.000	.000
21	A1210	.00	72.00	.000	.000
22	A1210	.00	72.00	.000	.000
23	A1220	.00	100.00	.000	.000
24	NONE	.00	.00	.000	.000
26	NONE	.00	.00	.000	.000
27	NONE	.00	.00	.000	.000
29	A1340	450.00	.00	.000	.000
30	A1380	.00	.00	.000	.000
32	NONE	.00	.00	.000	.000
34	A1390	100.00	.00	.000	.000
36	NONE	12.00	.00	.000	.000

ROW	KW	-----KW ADD, KW-----			-----KW FAC-----		
	KEY	W CRUISE	W BATTLE	S CRUISE	W CRUISE	W BATTLE	S CRUISE
1	NONE	4.00	10.00	4.00	.000	.000	.000
2	NONE	4.00	7.00	4.00	.000	.000	.000
3	NONE	8.20	10.30	8.20	.000	.000	.000
4	C+S	8.00	7.00	8.00	.000	.000	.000
5	C+S	90.00	475.00	90.00	.000	.000	.000
6	C+S	3.20	4.00	3.20	.000	.000	.000
7	NONE	-5.00	-10.00	-5.00	.000	.000	.000
8	NONE	3.00	4.20	3.00	.000	.000	.000
9	C+S	6.40	66.00	6.40	.000	.000	.000
10	NONE	5.00	10.00	5.00	.000	.000	.000
11	NONE	2.00	.00	2.00	.000	.000	.000
12	NONE	8.00	8.00	8.00	.000	.000	.000
13	NONE	5.00	10.00	5.00	.000	.000	.000
14	NONE	.00	25.00	.00	.000	.000	.000
15	NONE	.00	.00	.00	.000	.000	.000
16	NONE	12.00	1.00	12.00	.000	.000	.000
17	UNRE	.00	10.00	.00	.000	.000	.000
18	UNRE	.00	1.00	.00	.000	.000	.000
19	NONE	.00	.00	.00	.000	.000	.000
20	NONE	.00	.00	.00	.000	.000	.000
21	ARM	4.00	16.00	4.00	.000	.000	.000
22	ARM	4.00	16.00	4.00	.000	.000	.000
23	ARM	2.00	5.00	2.00	.000	.000	.000
24	NONE	.00	.00	.00	.000	.000	.000
26	NONE	.00	.00	.00	.000	.000	.000
27	NONE	.00	.00	.00	.000	.000	.000
29	ARM	.00	25.00	.00	.000	.000	.000
30	NONE	.00	.00	.00	.000	.000	.000
32	NONE	1.00	.00	1.00	.000	.000	.000
34	NONE	.00	.00	.00	.000	.000	.000
36	NONE	5.00	1.00	5.00	.000	.000	.000



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